Assessment

Forest Plan Revision

Draft Terrestrial Wildlife Report

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for:
Custer Gallatin National Forest

November 29, 2016

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Location

The Custer Gallatin National Forest (or Custer Gallatin) is located in southern Montana and western South Dakota. It consists of several geographically isolated land units extending from the Montana/Idaho border near the tri-state corner of Idaho, Montana, and Wyoming across southern Montana and into western South Dakota. The distance from the western Custer Gallatin boundary to its eastern most boundary is roughly 500 miles.

Inside the Custer Gallatin National Forest administrative boundary are 3,423,394 acres, of which 3,039,325 acres are National Forest System Lands. The Custer Gallatin includes portions of 10 counties in Montana and one county in South Dakota. The seven ranger districts offices are located in West Yellowstone, Bozeman, Livingston, Gardiner, Red Lodge, and Ashland, Montana, and Camp Crook, South Dakota. The Custer Gallatin Supervisor's office is located in Bozeman. Offices are also located in Big Timber and Billings, Montana.

Landscape Areas

Because of the diversity and extent of the Custer Gallatin, the national forest was divided into five "landscape areas" for this assessment (see Table 1 and Figure 1 and Figure 2). In this report, the Ashland and Sioux Landscape Areas are often referred to as the "Pine Savanna" ecosystem, while the remaining three landscape areas are often collectively referred to as the "Montane" ecosystem.

Table 1. Landscape area acreage

Landscape Area	Total Acres (All Ownerships)	National Forest System Acres within Area	Percent of Area in National Forest System Lands
Bangtail, Bridger, and Crazy Mountains	321,701	205,025	69%
Madison, Henrys Lake, Gallatin, Absaroka and Beartooth Mountains	2,343,529	2,158,640	87%
Pryor Mountains	77,944	75,067	82%
Ashland	501,596	436,133	87%
Sioux	178,625	164,460	92%
Forest Total	3,423,394	3,039,325	89%

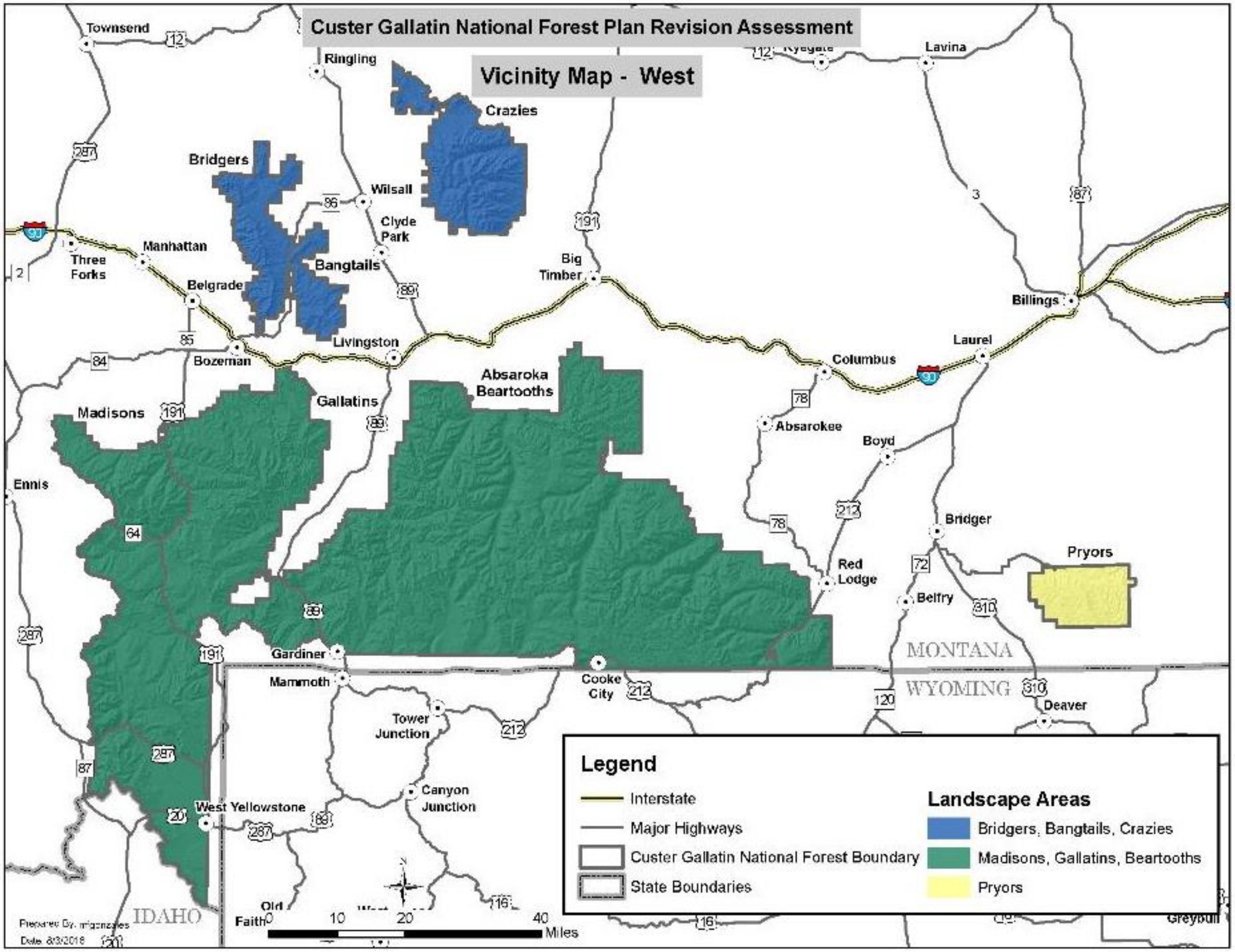

Figure 1. Landscape areas, west (Montane Ecosystem)

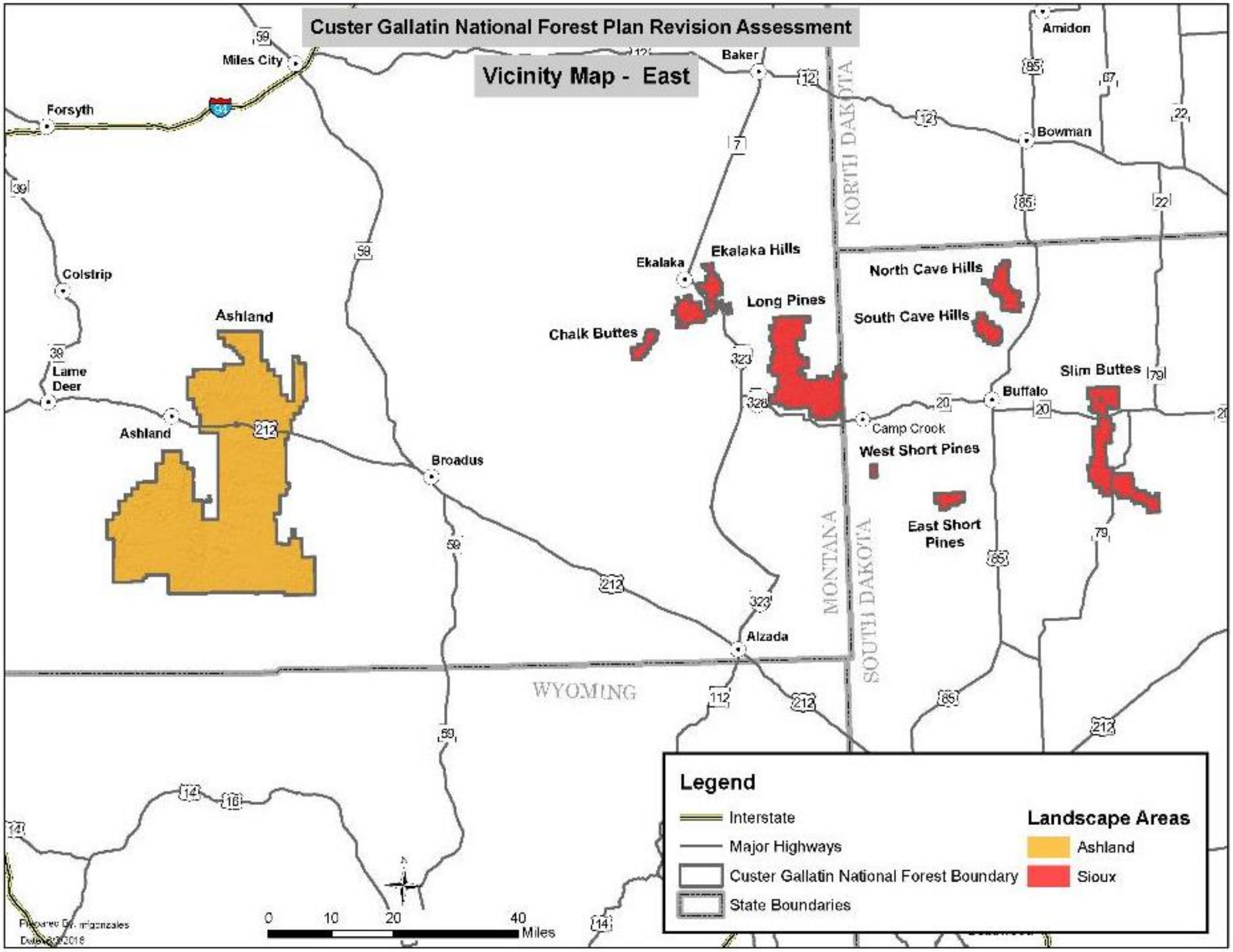

Figure 2. Landscape areas, east (pine savanna ecosystem)

Wildlife

Introduction

This section of the assessment deals with terrestrial wildlife species, including primarily land-dwelling birds, mammals, reptiles, and invertebrates. Aquatic species (fish, amphibians and aquatic or semi-aquatic invertebrates), as well as plants, are addressed in separate sections of the assessment. Many terrestrial wildlife species use habitat found on the Custer Gallatin National Forest (or Custer Gallatin) for some, or all of their life cycle needs. Because the Custer Gallatin provides such a wide variety of habitats, which in turn support a complex diversity of species, this section is divided into subsections. This first subsection addresses general habitat and ecological considerations for terrestrial wildlife, such as habitat diversity, connectivity, species diversity and richness, as well as system drivers and stressors acting upon terrestrial wildlife species and their habitats. In addition, this section briefly examines social, cultural, and economic benefits associated with terrestrial wildlife resources. Subsequent sections address individual species. Generally speaking, terrestrial wildlife are organized into three major categories: those species federally listed as threatened, endangered, candidate or proposed for listing under the 1973 Endangered Species Act; potential species of conservation concern, and species of public interest, all of which will be expanded upon in subsections to follow.

Process and Methods

Terrestrial wildlife species known to occur on the Custer Gallatin National Forest were evaluated relative to categories directed and defined by the National Forest Land Management Planning Final Rule and Record of Decision (hereafter 2012 Planning Rule), detailed in 36 CFR 219 2012. Forest Service Handbook (FSH 1909.12) provides specific, detailed directives for implementing the 2012 Planning Rule. These directives became effective in January 2015, and are the basis of the Terrestrial Wildlife Assessment. The 2012 Planning Rule at 36 CFR 219.6(b) specifies that assessments must identify and evaluate existing information relevant to the plan area for threatened, endangered, proposed and candidate species, as well as potential species of conservation concern present in the plan area. This assessment is based on the best available scientific, and where appropriate, anecdotal information, gleaned from published literature, agency reports, field guides, surveys and monitoring data. Geographic Information System (GIS) technology was used where appropriate to model wildlife habitat conditions for the assessment.

Under provisions of the Endangered Species Act, Federal agencies are required to conserve threatened and endangered species and to ensure that actions authorized, funded, or carried out by Federal agencies are not likely to jeopardize the continued existence of threatened or endangered species or result in the destruction or adverse modification of critical habitats. Lists of threatened, endangered, proposed, and candidate species are maintained by the USDI U.S. Fish and Wildlife Service, for each national forest in Montana on the website for the Ecological Services, Montana Field Office at http://www.fws.gov/montanafieldoffice/Endangered_Species/Listed_Species/Forests.html. The U.S. Fish and Wildlife Service still maintains separate lists for the Custer and Gallatin National Forest; the most current version of these lists (May 24, 2016) were used for this assessment. In South Dakota, the U.S. Fish and Wildlife Service maintains species lists by county, rather than by Forest Service administrative units. The portion of the plan area in South Dakota is entirely within Harding County; the list for Harding County is found on the website at http://ecos.fws.gov/ecp0/reports/species-by-current-range-county?fips=46063. Federally-listed threatened, endangered, proposed and candidate species that may occur within the plan area are addressed individually in following sections of this assessment.

Species of conservation concern are defined by the 2012 Planning Rule as “A species, other than federally recognized threatened, endangered, proposed, or candidate species, that is known to occur in the plan area, and for which the Regional Forester has determined that the best available scientific information indicates substantial concern about the species capability to persist over the long-term in the plan area” (36 CFR 219.9(c)). The Planning Rule Directives (FSH 1909.12.52a) state that the assessment will identify potential species of conservation concern and coordinate with the Regional Forester (FSH 1909.12.52b) to develop a list of potential species of conservation concern. Potential species of conservation concern are addressed individually in following sections of this assessment.

Finally, the Planning Rule requires the assessment to identify and evaluate available information pertaining to fish, wildlife, and plant species commonly enjoyed and used by the public for hunting, fishing, trapping, gathering, observing or sustenance, including cultural or tribal uses (FSH 1909.12; 13.35). Some of these considerations are addressed for at-risk species as described above. However, there are a number of terrestrial wildlife species that are neither federally-listed under the Endangered Species Act, nor meet the criteria for potential species of conservation concern, but are of high public interest in terms of opportunities for harvest, viewing, and/or spiritual/cultural considerations. Such species of public interest are also addressed individually in following sections of this assessment. Key social, cultural, and economic benefits are addressed for terrestrial wildlife species collectively, and individually where applicable. The reader should note that there is considerable overlap in analyses of the plan area’s contributions to social, cultural, and economic conditions, and that many benefits associated with terrestrial wildlife will be addressed in sections of the assessment pertaining to recreational uses and/or social and economic considerations.

Scale

The scale at which wildlife species were evaluated in this assessment varies depending upon the species’ characteristics and habitat needs, as well as based upon the information available. For example, with respect to wide-ranging species such as the grizzly bear, the assessment looks beyond the plan area to neighboring Federal, state, and private lands contained within the Greater Yellowstone Ecosystem for grizzly bears. For other species, such as the black-tailed prairie dog, the assessment is limited to a much smaller scale surrounding occupied prairie dog towns. For reporting purposes, wildlife analyses are presented by Custer Gallatin landscapes easily identified by the public. Since this subsection of the Terrestrial Wildlife Assessment deals with general habitat conditions, the analysis areas directly coincide with these landscapes.

For terrestrial wildlife, there are two distinct ecosystems within the plan area. The western side of the plan area is characterized by mountainous terrain, with high topographic relief, which will be referred to as the “Montane Ecosystem” in this assessment. The Montane Ecosystem covers an area of roughly 4,286 square miles, and includes the Madison/Henrys/Gallatin/Absaroka/Beartooth Mountains landscape; the Bridger/Bangtail/Crazy Mountains landscape; and the Pryor Mountain landscape, which make up the smaller scale analysis areas most familiar to the public, and therefore addressed separately below. East of the Pryor Mountains, the Custer Gallatin transitions to more gentle grasslands, pine forests, and badlands terrain, which will be referred to as the “Pine Savanna Ecosystem” in this assessment. The Pine Savanna Ecosystem covers an area roughly 1,063 square miles in size, including the Ashland and Sioux Districts of the Custer Gallatin. While there are some similarities in wildlife communities between these ecosystems, given the dramatic ecological differences between these ecosystems, there are notable differences in wildlife species composition as well. Generally speaking, species common to both ecosystems tend to be more habitat generalists, whereas the more specialized species occur in one system or the other, but not both.

Existing Information

The best available scientific information, including pertinent literature, data, and technology, relevant to the plan area and management concerns, was used to inform the evaluation for each species, group, and/or general habitat component considered in this assessment. The best available scientific information used included peer-reviewed published literature where available and pertinent to the plan area and/or species discussed, as well as unpublished reports, notes, or other documents that contain information relevant to the topic at hand. The best available scientific information for species occurrence, abundance, and distribution within or adjacent to the plan area included a variety of state and Federal databases, as well as local data or knowledge from Forest Service files, professionals, or other reliable resources. Best available scientific information sources are cited as appropriate within the subsection for each species, group of species, or in the project file.

The Montana Natural Heritage Program maintains an extensive and detailed database of species occurrences throughout Montana, which covers approximately 98 percent of the land base within the plan area. This system provides spatial and temporal data on known wildlife occurrences within the plan area, and was the first, and often the primary, source of information regarding various species presence, abundance, and distribution within the plan area. The Montana Natural Heritage Program data is based on actual observations, classified according to type and reliability of the observation. Observations are obtained from Montana Natural Heritage Program personnel through field work, as well as from other state and Federal agencies, private organizations, and individuals, and is currently the most accurate and comprehensive data sources for species occurrence in the plan area and surrounding landscape. The South Dakota Natural Heritage Program maintains a similar database for species occurrence in South Dakota. The portion of the plan area in South Dakota accounts for a minor (approximately 2 percent) of the total land base within the plan area. Species occurrence information was also obtained from the South Dakota Natural Heritage Program database, but that database has fewer occurrence records, and status rankings for some species are less current than those found in the Montana Natural Heritage Program database. In a cooperative effort, Montana Natural Heritage Program personnel have done some survey work in South Dakota, particularly in the portion (Harding County) that contains Custer Gallatin National Forest administrative units. Therefore, much of the species occurrence data for the South Dakota portion of the plan area were also obtained from the Montana Natural Heritage Program database.

Additional information on species occurrence in the plan area is available from the Natural Resource Management wildlife database. This database is used by the Forest Service to record and maintain wildlife observations occurring on National Forest System lands, or resulting from agency surveys. The Natural Resource Management database has fewer data, and overall less consistent coverage than the Montana Natural Heritage Program database, but may contain unique observation data, providing an important contribution to species information for the plan area. The Forest Service and several partners have been inventorying and monitoring birds across and beyond the plan area since at least the early 1990s. This effort includes the current Integrated Monitoring in Bird Conservation Regions program, the previous Northern Region Landbird Monitoring program associated with the Avian Science Center at the University of Montana, as well as surveys for other species not readily detected through these programs (woodpeckers and raptors, for example). Most of data obtained from these efforts have been incorporated into the Montana Natural Heritage Program and/or Natural Resource Management databases for agency use.

Information about species and habitat occurrences was also obtained from local, state, and Federal biologists and scientists, as well as private individuals either affiliated with groups known to gather such information, and for which the accuracy and reliability of information is known. In such instances, contacts were made directly with agency personnel and organization members. An appreciable amount of information came from state wildlife management agencies in the plan area, including Montana Fish, Wildlife & Parks, as well as South Dakota Game, Fish, and Parks personnel, as well as from state wildlife action plans from each agency. Life history and ecology information for individual species came from the state wildlife action plans, the Montana Field Guide (http://fieldguide.mt.gov/), which is an online publication shared by Montana Natural Heritage Program and Montana Fish, Wildlife & Parks, as well as from accumulated professional knowledge of agency personnel. The NatureServe website (http://explorer.natureserve.org/) provides global and state rankings, conservation status, information on distribution, native ranges, ecology and life history for species considered in this report.

In addition to scientific literature and species-specific data, GIS technology was used to help quantify, display, and evaluate terrestrial wildlife habitat conditions. A combination of data sources were used for wildlife habitat modeling. These included the Region 1 Vegetation Map (VMap), which is a geospatial dataset developed using the Region 1 Vegetation Classification System (Barber et al. 2011). VMap is a remotely sensed product derived from satellite imagery, aerial photography, and ground-based, field-verified sampling of vegetation communities. Region 1 has developed classifications to describe both existing and potential vegetative conditions. Potential natural vegetation is the vegetation that would become established if all successional sequences were completed without major natural or direct human disturbances under present climatic, edaphic, and topographic conditions (Manning, M., 2016, personal communication). Potential natural vegetation is likened to the concept of habitat types, which are defined as “aggregations of all land areas potentially capable of producing similar plant communities in the absence of disturbance” (Pfister et al. 1977). Potential vegetation type classifications are assemblages of Potential natural vegetation or habitat types with similar biophysical characteristics, disturbance regimes, species composition, structural characteristics, productivity, and successional trends into mature forests (Milburn et al. 2015). In other words, potential vegetation type provides a coarse-filter, broad-scale estimate of wildlife habitat conditions over time.

Existing vegetation classifications are assemblages of species dominance types, including information on tree species, canopy cover, size (diameter) and vertical structure (Barber et al. 2011). Forest Inventory and Analysis data provide actual, ground-verified information about vegetative conditions at a particular point in time. Forest Inventory and Analysis data are useful for informing wildlife habitat models and/or further refining VMap and potential vegetation type classifications to improve suitability for habitat modeling. The national Forest Inventory and Analysis program provides a statistically-based, continuous inventory of forest conditions in the United States. Forest Inventory and Analysis data provide details on status and trends in forest area and location; in the species, size, and health of trees; in total tree growth, mortality, and removals by harvest. Detailed information on the national Forest Inventory and Analysis program can be found at http://www.fia.fs.fed.us/.

Finally, databases containing information about human development, such as roads, trails, designated use areas, and communities, were used to help assess existing habitat conditions for wildlife, including factors such as habitat security and connectivity.

Current Forest Plan Direction

The existing Custer and Gallatin Forest Plans contain forestwide goals, objectives, and standards for wildlife and habitat, including some items directed at individual species, groups of species, and/or habitat conditions. The Gallatin Forest Plan includes general goals to provide for diversity of plant and animal communities and provide sufficient habitat for recovered populations of threatened and endangered species. The Custer Forest Plan includes goals to manage and/or improve key wildlife habitats, enhance habitat quality and diversity, provide habitat that contributes to the recovery of threatened and endangered species, and provide wildlife-oriented recreation opportunities. The Gallatin Forest Plan contains objectives to emphasize forage and cover needs on big game winter range, manage vegetation to maintain or improve habitat conditions, provide for vegetative diversity, and protect special habitat components. The Custer Forest Plan objective for wildlife is to actively manage habitat, while mitigating adverse effects from other resource activities, and giving special consideration to threatened and endangered species, as well as certain high interest species. Standards in both plans are often specific to particular species, habitats, or management areas, and are generally addressed in subsequent sections of this assessment for terrestrial wildlife species. Both plans contain monitoring requirements, such as: monitor population trends of indicator species and relationships to habitat changes (Gallatin), and monitor wildlife habitat changes associated with road construction and other activities, winter range capacity, population trends of certain species, condition of key habitats, and conflicts with livestock (Custer).

Reference Conditions

The Land Management Planning Handbook (FSH 1909.12.14a) recommends using the natural range of variation as the reference model for assessing ecological integrity, unless the information is lacking. At the time this assessment was conducted, Custer Gallatin National Forest personnel lacked adequate summary data for the natural range of variation assessment. However, there is some information in the literature about historical conditions. The western part of the Custer Gallatin National Forest (the Montane Ecosystem) is part of the world-renowned Greater Yellowstone Area, which basically includes the major landscapes within and surrounding Yellowstone National Park. The Greater Yellowstone Area covers approximately 92,000 square kilometers (roughly 35,500 square miles) in parts of Idaho, Montana, and Wyoming. This general geographic area is also often referred to as the Greater Yellowstone Ecosystem, particularly in reference to particular wildlife species, and the spatial extent may differ slightly relative to individual species distribution. This assessment will refer to both the Greater Yellowstone Area and the Greater Yellowstone Ecosystem, depending on the species and/or the terminology used in the literature cited. The Greater Yellowstone Area is perhaps the largest intact ecosystem in the continental United States (McIntyre and Ellis 2011), and one of the largest intact temperate zone ecosystems in the world (Ebinger et al. 2016). Given the notoriety of the Greater Yellowstone Area, there has been an abundance of scientific research conducted, producing a variety of literature on past and present ecological conditions in the area. However, the same is not true of the Pine Savanna ecosystem found on the eastern side of the Custer Gallatin National Forest where, compared to the Greater Yellowstone Area (Montane Ecosystem), there is a lack of information regarding past ecological conditions.

Due to the remote location of the Greater Yellowstone Area, its often harsh environment, and the early (1872) establishment of Yellowstone National Park as a nature reserve, human colonization and subsequent development of the Greater Yellowstone Area was slower than in other areas of the United States. Consequently, the ecosystem is largely still intact, with vast areas relatively untrammeled by man. The period of European settlement in the Greater Yellowstone Area (1870s to present) was preceded by the Little Ice Age. Cold, wet conditions associated with the Little Ice Age suppressed wildfire, producing large expanses of mature and older forest due to the lack of disturbance. A warming trend following the Little Ice Age, combined with fire suppression associated with European settlement of the area, continued this trend favoring higher proportions of late-succession forests. In addition to fire suppression, domestic livestock grazing reduced fine fuels in some areas, further limiting fire effects. These conditions resulted in conifer encroachment into grass and shrub habitats, further increasing the proportion of forested habitat upon the landscape, with corresponding reductions in grassland, deciduous tree, and shrub habitats, particularly notable at lower elevations (Hansen 2006).

Large fires were essentially absent from the Greater Yellowstone Area from the time of the Little Ice Age until the late 1980s. In 1988, fires burned nearly 1.5 million hectares (roughly 3.5 million acres) in the Greater Yellowstone Area (Hansen 2006), of which, approximately 107,000 acres burned within the Montane Ecosystem of Custer Gallatin National Forest. Tinker and others (2003) examined effects of the 1988 fires within Yellowstone National Park, which is adjacent to the Montane Ecosystem on the Custer Gallatin National Forest, and has similar habitat types. They found that these large fires created a structurally divergent landscape from that influenced by smaller fires that burned previously (from 1705 to 1985). The 1988 fires burned in a mosaic pattern, which resulted in smaller patch size, with a larger number of distinct patches of homogenous vegetation across the landscape. Interestingly, the proportion of edge after the large fires was similar to edge density created by smaller fires. Size, shape, and distribution of patches, as well as edge density, all influence habitat suitability for wildlife. Habitat specialists tend to do well in larger continuous patches with lower edge density, whereas more generalist species thrive in landscapes with smaller patch sizes and larger proportions of edge. Due to natural gradients in elevation, geology, soils, climate and topography, habitat in the Rocky Mountains is naturally more patchily distributed than in other parts of the United States, such as the North American prairie (Hansen 2006). The Montane Ecosystem of the Custer Gallatin National Forest falls within the Rocky Mountains, whereas the Pine Savanna Ecosystem is more aligned with conditions in the North American prairie.

Existing Condition

Wildlife habitat on the Custer Gallatin National Forest is extremely diverse ranging from the rugged topography and alpine environs associated with the highest peaks in the State of Montana, to the slightly more temperate coniferous forest slopes of the Montane, to the pine forests, grasslands, shrublands, woody draws and badlands types more characteristic of the Pine Savanna Ecosystem. The Custer Gallatin National Forest landscape ranges in elevation from just below 3,000 feet on the Sioux District in the Pine Savanna Ecosystem to well over 12,000 feet in the Beartooth Mountains of the Montane Ecosystem. Snow is a major form of precipitation in the Montane Ecosystem, generally falling as dry powder, and often reaching cumulative depths of over 350 centimeters (over 100 inches). At higher elevations, snowpack can persist for 9 months (or more) each year (McLure et al. 2016). Vegetation across the plan area is dominated by coniferous forest, with inclusions of open meadows and riparian areas, and interspersed with rocky features. Alpine habitat occurs above timberline in the Montane Ecosystem and includes tundra, cliffs, talus, bedrock, glaciers, high lakes and streams. In the Pine Savanna Ecosystem, badlands, or barren landscapes characterized by roughly eroded buttes, pinnacles and spires, occur below timberline.

In very general terms, the Montane Ecosystem contains grasslands and sage-steppe at the lowest elevations. Coniferous forest begins to occur on the landscape in the Montane foothills, with Douglas-fir (*Pseudotsuga menziesii*) and limber pine (*Pinus flexilus*) the dominant species at lower elevations. Ponderosa pine (*Pinus ponderosa*) is relatively rare in the Montane Ecosystem, and is found generally at the lower elevation treeline in the eastern portion of the Montane Ecosystem. Forested habitat transitions at mid-elevations and cooler aspects to lodgepole pine (*Pinus contorta*), spruce (*Picea engelmannii*), and subalpine fir (*Abies lasiocarpa*) more typical of boreal habitat. Whitebark pine (*Pinus albicaulis*) is a dominant species at the upper treeline, but is often mixed with lodgepole pine, spruce, and subalpine fir. Aspen (*Populus tremuloides*) is a relatively rare occurrence in the Montane Ecosystem, often tied to moist microsites. Riparian shrub habitats are associated with streams, lakes and wetlands over a wide elevational range. Alpine tundra, bedrock, talus and water dominate the landscape above treeline.

In contrast, the Pine Savanna Ecosystem is a patch mosaic of pure ponderosa pine stands within a mixed grass prairie. The grassland matrix occurs in the lower elevation bottom lands, with the pine forests dominating at higher elevations, often occurring on the tops of rolling hills, buttes, and mesas. The Pine Savanna Ecosystem also supports mixed deciduous-conifer woody draws, which are not typical in the Montane Ecosystem. However, like the Montane Ecosystem, riparian hardwood-shrub communities are interspersed throughout, associated with perennial and intermittent streams. Whereas the Montane Ecosystem is characterized by alpine habitat above timberline, the Pine Savanna Ecosystem is noted for badlands types where total vegetation cover is generally less than 9 percent. Other specialist reports contain detailed descriptions of key ecosystem characteristics, such as vegetation lifeform (tree, shrub, grass, etc.), cover type (plant species), distribution, density, that provide habitat components for terrestrial wildlife species.

Species Diversity

The plan area's great habitat diversity and associated complexity provides conditions for a vast array of wildlife species and guilds. Currently, the Montane Ecosystem of the plan area contains the complete suite of native fauna that existed prior to European settlement of the western United States (Hansen 2006), including recovered populations of bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), and gray wolf (*Canis lupus*), which were all threatened with extinction since the time the Custer and Gallatin National Forests were established. With the exception of a few notable species such as black-footed ferrets (*Mustela nigripes*), the eastern landscapes also supports a nearly complete complement of species native to the Pine Savanna Ecosystem that occurs there. Between the Montane and Pine Savanna Ecosystems, the Custer Gallatin National Forest hosts a remarkable diversity of native terrestrial fauna. According to the Montana Natural Heritage Program website (http:// mtnhp.org), at least 79 mammal species, 262 bird species, 11 reptile species, 9 amphibian species, 17 fish species and 291 invertebrate species have been recorded in the plan area. (Note that fish, amphibians, and aquatic invertebrate species are addressed in a separate section of this assessment.) Some of these species are migratory, and may spend only a season here, or may just pass through during travels between seasonal ranges elsewhere, while others may spend their entire lives within the plan area.

Many of these terrestrial wildlife species on the Custer Gallatin National Forest are generalists, and as a result, are common and widespread across the entire plan area. For example, red squirrels (*Tamiasciurus hudsonicus*), mule deer (*Odocoileus hemionus*), and American robins (*Turdus migratorius*) are ubiquitous, and found across all Custer Gallatin landscape units. However, because the Montane and Pine Savanna Ecosystems are so different from each other, some species are typically found in either the Montane or Pine Savanna Ecosystems, but not both. For example, the great gray owl (*Strix nebulosi*) and American marten (*Martes americana*) are found in the Montane Ecosystem, but not in the Pine Savanna Ecosystem, whereas black-tailed prairie dogs (*Cynomys ludovicianus*) and burrowing owls (*Athene cunicularia*) are found in the Pine Savanna Ecosystem, but not the Montane.

There are a number of "keystone" species present in the plan area that can and often do have a significant effect on plant and animal species distribution and habitat diversity. For example, the Custer Gallatin National Forest hosts a variety of predators, ranging in size from bears to weasels, and eagles to kestrels, which has influenced population levels and distribution of big game species as well as small mammals, birds, and insects. The broad-scale diversity across the plan area (Pine Savanna versus Montane Ecosystems), combined with fine-scale diversity (such as variation in elevation, aspect, slope, vegetation communities, and structural stages), is needed to sustain the high level of existing species diversity.

Ecological engineers are also present within the plan area. Beavers (*Castor Canadensis*) have increased in distribution over time, and as a result, have affected stream flow, water tables, and riparian vegetation in occupied areas. Herbivores, such as large ungulates (including native species as well as domestic livestock), have influenced vegetation structure, composition, and distribution in the plan area. For example, elk in the Montane Ecosystem have had notable impacts on plant communities, causing increased diversity in herbaceous species, and corresponding declines in woody vegetation (Hansen 2006). Insect species, such as mountain pine beetle, have had a notable effect on forested habitat composition in recent years, including reductions in live tree canopy and associated cover in some areas, as well as increased availability and distribution of snags and down woody debris. Other insects play an important role in pollination. Birds and small mammals can influence habitat through seed dispersal. Bats, as well as a number of bird species, are key instruments of pest control.

Habitat Diversity

As noted above, the Custer Gallatin contains a remarkable amount of habitat diversity, both within and between the Montane and Pine Savanna Ecosystems. Topography, hydrography, soils, climate and disturbance, largely dictate vegetation patterns that produce terrestrial wildlife habitat conditions within the plan area. These factors provide food, water, and shelter for wildlife. Generally speaking, areas of high habitat diversity not only provide for greater wildlife species diversity, but also tend to be more resilient to stressors such as fire, floods, insects, disease, drought, and ultimately, even climate change (WGA 2008:2). Habitat diversity facilitates wildlife movement between different conditions necessary to support various life cycle stages. For example, many big game species move between seasonal ranges for breeding, foraging, and shelter, whereas most bird species migrate to warmer climates, often entirely outside of the plan area, during winter. Omnivorous species like black bears (*Ursus ameicanus*) and grizzly bears (*U. arctos*) move up in elevation, following snowmelt and associated plant phenology as well as movement of prey species (Hansen 2006). Additional habitat considerations are addressed for individual species or guilds in subsections of this terrestrial wildlife assessment.

Habitat Connectivity

Habitat connectivity is widely recognized as a crucial component for maintaining biodiversity and managing for viable populations of native species (USDA Forest Service 2006; Western Governors' Association 2008; Hansen 2009; Cushman et al. 2010; McIntyre and Ellis 2011; Parks et al. 2012; Cushman et al. 2012; Wade et al. 2015; Haber and Nelson 2015; McLure et al. 2016). While habitat connectivity is a prominent topic in the scientific literature, including specific focus on the Greater Yellowstone Area (the Montane Ecosystem in the plan area), there is very limited information regarding terrestrial habitat connectivity in the Pine Savanna Ecosystem of the plan area. Connectivity is defined under the 2012 Planning Rule as the "ecological conditions that exist at several spatial and temporal scales that provide landscape linkages that permit the… daily and seasonal movements of animals within home ranges, the dispersal and genetic interchange between populations, and the long distance range shifts of species, such as in response to climate change" (36 CFR 219.19). There are two primary requirements for habitat connectivity. The first is that suitable habitats are present for species of interest, and the second is that there are no barriers to movement (USDA 2006).

Conditions that present habitat suitability, as well as barriers to movement, vary widely between species. It follows logically that landscape connectivity also differs by individual species, based on daily, seasonal, and life-time habitat needs. Corridors that facilitate movement by one species may not be suitable, and may even present barriers for movement of another species. Similarly, landscapes that facilitate dispersal out of the home range for a species may not provide habitat required to support long-term occupation by that same species (McLure et al. 2016). For example, large, unbroken tracts of mature forest cover are important to forest carnivore species such as the American marten. Yet for other species, including pronghorn antelope (*Antilocapra americana*), bighorn sheep (*Ovis canadensis*), and black-tailed prairie dog, dense forested habitat is not highly suitable, and conifer encroachment into grassland or shrub-steppe habitats can reduce habitat suitability and impede movement for these species. Forest cover can provide security cover to facilitate movement of big game species such as elk (*Cervus elaphus*), deer, moose (*Alces alces*) and bear; however these species also rely on forest openings and grass/shrub habitats to find adequate forage. Similarly, Ruediger and others (2000) noted that dispersing lynx (*Lynx canadensis*) will move through large areas of limited forest cover, but such habitat is generally not considered suitable for residential (long-term) use by lynx.

Habitat connectivity is also influenced by the dispersal capability of a species and individuals. For example, with the ability to fly, birds are capable of moving between habitat patches on a daily basis, making long-distance migratory movements between seasonal habitats more easily than ground-based terrestrial wildlife. Generally speaking, large-bodied animals have greater dispersal capability than smaller animals. For example, while they occupy similar habitats, the wolverine (*Gulo gulo*), a mid-sized forest carnivore, has much greater dispersal capability than the fist-sized American pika (*Ochotona princeps)* (Parks et al. 2012). Connectivity corridors identified as high priority for conservation of biodiversity are often identified from observed movement patterns of large-bodied, wide-ranging species. However, wide-ranging animals capable of long-distance movements are often habitat generalists, and therefore may not adequately represent the habitat needs, or dispersal capabilities of other species (Cushman et al. 2012).

The reason for movement also plays a role in the assessment of habitat connectivity. For example, long-range dispersal movements may contribute to gene flow between populations, genetic rescue of small or isolated populations, and/or colonization of new areas (Parks et al. 2012). Habitats used to move within an individual's seasonal home range may be quite different than those used for movement between seasonal ranges, and can be dramatically different than areas used for dispersal to establish new home ranges. Not all movements undertaken by animals are beneficial. Movement to escape a possible predator or other disturbance can place an animal in unfamiliar territory. Likewise, exploratory movements outside of home ranges are often undertaken by inexperienced subadult animals, which may relocate that animal into less suitable, or even unsuitable habitat (Wade et al. 2015).

Haber and Nelson (2015) defined structural connectivity as "the physical relationship between patches of habitat…" and functional connectivity as "the degree to which landscapes actually facilitate or impede the movement of organisms and processes of ecosystems." They noted that fragmentation, which is the breaking-up of contiguous patches into smaller, disconnected patches, can introduce barriers to connectivity. While this notion is informative in the evaluation of landscape connectivity, it is important to consider that habitat in the Rocky Mountains (including the Montane Ecosystem of the Custer Gallatin National Forest) is naturally more patchily distributed than in other parts of the United States, such as the North American prairie (Hansen 2006), which is similar to parts of the Pine Savanna Ecosystem of the Custer Gallatin National Forest.

Given the importance of habitat connectivity for maintaining species viability and associated biological diversity, a great deal of attention has been devoted to identifying potential movement corridors, as well as potential barriers to movement, for terrestrial wildlife species (USDA Forest Service 2006; Hansen 2006; WGA 2008; Cushman et al. 2010; Parks et al. 2012; Haber and Nelson 2015). One concept for evaluating habitat connectivity involves the identification of key linkage areas, including areas where habitat connectivity has been reduced by human development. Ruediger and others (1993, cited in USDA Forest Service 2006) identified key linkage areas for large- and mid-sized carnivores in the northern Rocky Mountains. Based on this, and other work, the Gallatin Forest Travel Management Plan (USDA Forest Service 2006) incorporated an assessment of biological corridors, and identified key linkage areas near the Custer Gallatin boundary, where wildlife movement is desirable for genetic exchange between blocks of National Forest System lands, but likely to be restricted by permanent development such as highways, railroads, agricultural lands and residential areas. As a result, the Gallatin Travel Plan includes a goal to provide for wildlife movement and genetic interaction, and an objective to provide habitat connectivity consistent with wildlife movement patterns between mountain ranges within the Forest boundary. Travel management plans for the Beartooth, Ashland, and Sioux Ranger Districts also note wildlife corridors as concerns and analyze potential impacts to wildlife habitat connectivity related to travel management in the final environmental impact statement, but contain no specific direction for wildlife corridors in the associated records of decision.

Popular methods for modeling wildlife movement corridors include landscape resistance modeling, often referred to as “least cost path” or “least cost corridor” models, which operate under the concept that animals will choose to travel along routes with the least ecological cost (that is; the lowest cumulative resistance between their current and target locations on the landscape). Least cost path and least cost corridor models assume that all such paths/corridors contribute equally to connectivity on the landscape, that all animals have equal dispersal capability (Parks et al. 2012), that animals are goal-oriented and have the desire to move between their current and target locations, and that animals have absolute knowledge of their surrounding landscape (Wade et al. 2015; McLure et al. 2016). Circuit theory models provide an alternative to least cost models, by applying concepts related to flow of charged bits through an electrical circuit, to animal movement through the landscape. Circuit theory models assume that repeated use of routes between source and target locations infers better flow between points. In contrast to least cost models, circuit theory models assume that animals have no previous knowledge of the surrounding landscape. Therefore, one might expect least-cost models to be more representative of traditional movement patterns between seasonal ranges of herd animals (where there is collective knowledge of the landscape), whereas circuit models might be more useful for identifying exploratory or dispersal movements of animals out of known home range territories (McLure et al. 2016).

Habitat connectivity and/or movement corridor modeling has promising utility for the identification of high priority areas for protection and/or restoration, in order to sustain functional connectivity across the landscape. However, as mentioned above, models are based on many assumptions. Wade and others (2015) examined a number of resistance-surface-based models (least cost models) and identified a considerable number of issues with such modeling efforts, such as failure to specify the temporal aspect of potential corridors (daily, seasonal or lifetime movement, for example), the purpose for modeled connector routes (for example foraging, breeding, dispersal, etc.), or the biological rationale for selection of model-assigned resistance features. These authors stressed that process modeling (such as for wildlife movement) is often based on assumptions that are not supported by data.

Model validation with independent, empirical data is of course desirable, but not always possible. Further, while methods for validating connectivity models against empirical data exist, they have not been standardized (McLure et al. 2016). On the other hand, without any validation, the reliability of a model is basically unknown. In the absence of empirical data, expert opinion is a commonly used basis to derive model parameters. Many such connectivity models are based on general assumptions about habitat characteristics that are believed to have commonalities for a majority of species; for example low level of human impacts, or a high degree of intact forest cover. While expert opinion has value, it is the least robust method of model validation. To illustrate the importance of model validation, Wade et al. (2015) gave an example where independent radio-tracked movement of an animal was substantially different than the corridors predicted by a least cost model, and remarked that because animals are influenced by independent needs, such as seeking food and/or avoiding predators, strict adherence to a least cost path is not likely.

While movement corridor modeling may be a valuable tool for examining habitat connectivity, the many iterations required to do such modeling for the wide range of species present on the Custer Gallatin National Forest, combined with the many spatial and temporal variables associated with each species, results in a convolution of factors far too complex for this assessment. As an example of the complexity, Montana Fish, Wildlife & Parks evaluated habitat connectivity for the entire state, including most (about 98 percent) of the plan area. The final report is nearly 300 pages (Montana Fish, Wildlife & Parks 2011). Further, many wildlife movement corridor modeling efforts identify corridors that are largely outside of the plan area as having the greatest threats from human development, and therefore the highest priorities for conservation purposes.

An alternative method to evaluate habitat connectivity as it relates to ecosystem integrity is to examine the amounts, distribution, and status of human development and access within the plan area and surrounding landscape. Construction of roads, mines, administrative sites and developed recreation areas results in relatively permanent habitat alteration that affects connectivity for wildlife. Certain land management designations restrict the types and amounts of development and associated use allowed on National Forest System lands. Land use restrictions can add a degree of protection for important wildlife habitat components such as habitat security, which helps maintain habitat connectivity. This evaluation operates on the premise that designation of areas such as wilderness, wilderness study and/or inventoried roadless, regulates the amount of habitat loss, degradation, and fragmentation that occurs due to human activities (Dietz et al. 2015), and that the resulting network of designated areas thereby facilitate conservation of habitat connectivity for wildlife movement (Cushman et al. 2012). Although designated areas typically provide a higher degree of overall habitat connectivity for wildlife by restricting the amount of permanent habitat alterations that may be inflicted by humans, all federally-owned lands generally provide protection from permanent residential and urban development, yet allow for some level of resource utilization and associated transportation systems.

In the plan area, designated wilderness areas permanently bar most human-caused conversion of natural land cover. Natural disturbance events are generally allowed to occur without management interference (although wildfire is sometimes suppressed), and management activities and recreational pursuits are limited to more primitive means. Other designated areas such as inventoried roadless areas, recommended wilderness, wilderness study areas, and research natural areas generally preclude permanent conversion of natural land cover, with a goal to maintain a mostly natural state, but in which some limited management activities, including low levels of resource utilization, are allowed. Parts of the plan area outside of designated areas are managed for uses such as timber harvest and mining, as well as recreational uses which may involve permanent developments such as roads, trails, campgrounds, etc. The Existing Designated Areas report (Oswald, L. 2016) contains detailed information about the various “designated areas” within the plan area (wilderness and inventoried roadless areas, for example). This wildlife specialist report uses GIS-generated figures to evaluate the varying degrees of land management designations that preserve natural character, and thus maintain a greater degree of wildlife habitat connectivity across the plan area. An assumption made in this analysis is that private, state, and other land ownership within the plan area boundaries (roughly 11 percent of the land base) are managed similar to Federal lands outside of designated areas.

Nearly 35 percent of the land base within the Custer Gallatin National Forest plan area is contained in wilderness areas designated by Congress. These areas, which include parts of the Absaroka-Beartooth, and Lee Metcalf Wilderness Areas, are intended to preserve wilderness character on the landscape, thus providing large blocks of wildlife habitat relatively undisturbed by human development and by association, the greatest habitat connectivity for wildlife. Over 25 percent of the plan area falls within some other designated area, such as inventoried roadless or wilderness study areas, which typically restrict the amount of road construction and associated activities, but still allow for some resource utilization and/or motorized use. The remainder of the plan area, which is less than half of the land base, is outside of designated areas and more readily available for higher levels of resource utilization and recreational development than are designated areas. In general, National Forest System lands regardless of land management designations, provide a higher degree of protection for wildlife habitat than do many areas outside of the plan area, which may have little or no protection from permanent conversion of the landscape. Inside the plan area, most non-Federal inholdings are small, isolated parcels, with management actions similar to multiple use activities on Federal lands outside of designation areas. However, it should be noted that there are large blocks of non-Federal lands, most notably in the Big Sky area in the Madison Mountain Range, as well as the west side of the Bangtail Range, that are already developed to some degree and subject to further development.

While an assessment of designated areas provides insight into the availability of relatively pristine wildlife habitat and associated landscape connectivity, the proportion of designated areas alone does not tell the entire story. Distribution is also important, particularly as it relates to habitat connectivity across the plan area and larger landscape. The Custer Gallatin National Forest has a natural, ecological separation between the Montane Ecosystem to the west, and the Pine Savanna Ecosystem to the east. All of the designated wilderness is located in the Montane Ecosystem, which puts roughly 38 percent of the Montane Ecosystem in the highest category for undeveloped, unroaded lands. Another 30 percent of the Montane Ecosystem is in mid-level designated areas (for example, inventoried roadless, recommended wilderness, wilderness study area), leaving about 32 percent of the Montane Ecosystem widely available for multiple-use management. In contrast, none of the Pine Savanna Ecosystem of the Custer Gallatin National Forest is currently in designated wilderness. Nearly all (94 percent) of the Pine Savanna Ecosystem is open to a wider range of land management activities, while about 6 percent are within inventoried roadless areas.

By comparison, McIntyre and Ellis (2011) addressed landscape dynamics in the Greater Yellowstone Area, including a quantification of “protected areas”. These authors reported 18 percent of the Greater Yellowstone Area managed as wilderness (primarily Forest Service, but also some BLM), with an additional 11 percent of the Greater Yellowstone Area managed by the National Park Service. They considered these areas collectively to have the highest protected status in the Greater Yellowstone Area, for a total of 27 percent. They also reported 43 percent of the Greater Yellowstone Area lands as having some level of protection, but also being open to uses such as timber harvest, mining, and off-highway vehicle use. A direct comparison to the methods used for evaluating designated areas on the Custer Gallatin National Forest cannot be made, because the Greater Yellowstone Area assessment did not specifically evaluate contributions of designated areas such as inventoried roadless or wilderness study areas. Also, the GYA assessment considered all National Park Service lands as having the highest level of protection, which does not account for large developments such as Fishing Bridge and Old Faithful. This comparison does however, demonstrate to some degree that the Montane Ecosystem of the Custer Gallatin National Forest is at least on par with the Greater Yellowstone Area for “protected areas” that contribute to wildlife habitat connectivity.

No similar large-scale analysis was found that included the Custer Gallatin National Forest Pine Savanna Ecosystem. However, Cushman and others (2010) assessed landscape connectivity for individual wildlife species in the North American Great Plains Region. The study area for the Great Plains assessment did not include lands on the Custer Gallatin National Forest, but included similar habitats located to the south and east of the Custer Gallatin National Forest Pine Savanna Ecosystem. Cushman et al. (2010) did not specifically measure degree of protection, or quantify designated areas in general, but rather identified core areas, which they defined as the portion of the study area expected to be occupied by a particular species of interest. While this study does not provide a direct comparison for the Custer Gallatin National Forest Pine Savanna Ecosystem, the conclusions are similar to those found specific to the Greater Yellowstone Area, as well as in the literature for habitat connectivity in general; that being that identifying and maintaining core areas and key movement corridors between those areas, is fundamental to sustaining habitat connectivity across the landscape in order to preserve biodiversity. Although the Pine Savanna Ecosystem landscapes of the Custer Gallatin National Forest may be less protected and more spread out than the Montane Ecosystem, it is important to note that there are fewer permanent residents and visiting recreationists in eastern Montana and northwestern South Dakota, so the human demands on the Pine Savanna Ecosystem landscapes are currently less than in the Montane Ecosystem of the Custer Gallatin National Forest.

Another important factor to consider regarding the distribution of designated areas is elevation. A number of studies note that federally managed lands (once broadly referred to as “nature reserves” or “forest reserves”) are typically located at higher elevations, often on less productive land, whereas lower elevation, valley bottoms that are typically more productive, are generally held in private ownership (Hansen 2006, 2009; McIntyre and Ellis 2011; Cushman et al. 2012; Belote and Aplet 2014; Dietz et al. 2015). While there are conservation easements on private lands, the large-scale designated areas are almost exclusively found on Federal lands (Belote and Aplet 2014). Within Federal lands, it is widely recognized that the highest degree of land use restriction (found in designated wilderness) is often disproportionately located at higher elevations, and this is generally true of the Custer Gallatin National Forest. The Absaroka-Beartooth Wilderness Area includes the tallest peaks on the Custer Gallatin National Forest, plus high lake plateaus, and a good portion of alpine and subalpine habitats in the Absaroka and Beartooth Mountains. Likewise, the Lee Metcalf Wilderness Area includes the highest mountains in the Madison Range, plus associated alpine and subalpine habitat. Other designated areas (inventoried roadless and wilderness study areas, for example) are also disproportionately represented in the higher elevations, where steeper, more rugged terrain often limits road access and associated management actions. However, while it is generally accepted that designated lands are typically at higher elevation, in less productive lands, it is also important to recognize that there are unique ecological values associated with alpine habitats (Belote and Aplet 2014).

As a result of the elevational gradient between designated areas and more developed land, most of the permanent human-caused land conversion (such as, agricultural land, transportation systems, residential and commercial development) is concentrated at lower elevations in the valley bottoms, which are generally the most productive areas in terms of soil nutrients and growing season, as well as associated plant and animal diversity (Hansen 2006). The majority of these highly productive lowlands are located outside of the Custer Gallatin National Forest plan area. Even within the plan area, there is a similar elevation gradient, where the most productive lands tend to be at the lower elevations outside of designated areas, whereas the more restricted use areas such as wilderness and inventoried roadless areas, are typically found at higher elevations. Consequently, a larger proportion of extractive uses such as timber harvest, as well as associated transportation systems, have occurred in lower elevation lands within the plan area. While this scenario has resulted in disproportional land use impacts at lower elevations in more productive habitats, a potential moderating factor is that the more highly productive lands may also be more resilient to human-caused disturbances. However, the legacy often associated with land management activities (such as road systems) can negate some of the natural resilience factor (Belote and Aplet 2014). The Western Governors' Association (2008) has pointed out that areas of highest productivity and diversity are more likely resilient to natural stressors as well, including disturbances such as drought, fire, insects, disease, and ultimately climate change.

A final consideration for habitat connectivity is geographic separation and habitat fragmentation. The Custer Gallatin National Forest is made up of a number of distinct units, some of which are isolated from the rest by mostly private lands. Geographic separation is the more difficult factor to manage for in terms of habitat connectivity, because the Custer Gallatin National Forest has no authority over lands separating the distinct units of the plan area. None-the-less, the geographic spread of the plan area, which is over 500 miles from west to east, is a factor in habitat connectivity and associated movement of organisms. Given the spatial separation and significant ecological differences between the Pine Savanna and Montane Ecosystems of the plan area, it is a logical assumption that movement between these ecosystems has historically been at low levels relative to movement within these ecosystems.

Habitat fragmentation, on the other hand, is something that can occur both within and between Custer Gallatin National Forest administrative units. Habitat fragmentation generally occurs when a disturbance or process changes existing vegetation to a condition that is substantially different from adjacent or surrounding conditions, thus breaking up larger, homogenous vegetation patches into smaller, dissimilar patches. Fragmentation can result from either natural or man-caused disturbances (wildfire or timber harvest, for example), as well as from processes such as forest succession (tree growth), which can result in conifer encroachment into meadows. Disturbances that result in fragmentation are often temporary. For example, mature trees removed through wildfire or logging will typically grow back. However, more permanent changes can occur, such as landslides that change topography and soils conditions, or permanent human development. By far, the majority of vegetation changes on National Forest System lands within the plan area, whether caused by natural process or by human use, have been temporary in nature. Disturbances have altered existing vegetation cover types, but have not altered the biophysical characteristics (habitat types) that dictate climax conditions for vegetation. Some permanent changes have resulted from natural events such as earthquakes (such as at Hebgen Lake in 1959), as well as conversions from management actions such as road construction/maintenance, damming of reservoirs, clearing of trees for developed ski areas (such as Bridger Bowl and Red Lodge Mountain), recreation residences, administrative sites, and developed campgrounds. Such permanent conversions represent a very small proportion of National Forest System lands within the plan area (less than 1 percent).

Large landscapes such as the Custer Gallatin National Forest experience a wide variety of disturbance and succession processes over time. Disturbance factors generally occur at a small scale relative to the size of the plan area. As some areas are maturing after the last disturbance, others are experiencing new disturbances, resulting in a wide range of habitat conditions over time (structural diversity). A landscape where disturbances occur at a variety of spatial and temporal scales may achieve a "dynamic steady-state equilibrium", where individual patches are at varying stages of succession, but the larger landscape maintains a relatively constant mix and proportion of seral stages. Wildlife species native to the Custer Gallatin National Forest have adapted to changing conditions resulting from natural processes for millennia. Some species are more specialized with a narrow set of habitat requirements, whereas others are more generalist and can take advantage of a variety of conditions. Habitat specialists and generalists alike require an environmental gradient of conditions (a mix of early-, mid- and late-seral stages) (Hansen 2006). At the time of this assessment, summary data for evaluating proportions and distribution of seral stages over time (the natural range of variation) were not available. The Vegetation specialist report describes the current variation of vegetative types and successional stages found across the plan area.

As noted previously, habitats in the Rocky Mountains (such as the Montane Ecosystem of the Custer Gallatin National Forest), tend to naturally be more patchy and diverse than other areas, such as the Northern Great Plains (which is more representative of the Pine Savanna Ecosystem of the Custer Gallatin National Forest). As a result, some scientists believe wildlife native to the Rocky Mountain environment are well adapted to more patchy (or more naturally fragmented) landscapes. For example, a synthesis of forest fragmentation in the Rocky Mountains of Wyoming and Colorado found no bird or mammal species that was strongly associated with large, contiguous forest patches (Hansen 2006).

A brief discussion of general wildlife habitat and condition by distinct Custer Gallatin National Forest landscape is provided below.

Unique Landscapes of the Custer Gallatin National Forest

Madison, Gallatin and Absaroka and Beartooth Mountains

The Madison, Gallatin, Absaroka and Beartooth landscape within the Montane Ecosystem contains the greatest proportion of designated areas, including all of the highest protection level found in designated wilderness areas, which cover approximately 45 percent of this landscape. The remainder of the landscape is roughly 28 percent other designation (inventoried roadless and wilderness study area), and 27 percent outside of designated areas. This landscape is the largest, at nearly 70 percent of the Custer Gallatin National Forest plan area, and as such provides the most contiguous habitat for wildlife, although it is divided by the Gallatin River corridor and Montana Highway 191, as well as the Yellowstone River corridor and Highway 89. In addition to being the largest contiguous block of wildlife habitat with the greatest proportions of designated areas within the plan area, this landscape abuts the Lee Metcalf Wilderness Area in the Beaverhead-Deerlodge National Forest to the west, Yellowstone National Park to the south, and the Absaroka-Beartooth Wilderness in the Shoshone National Forest to the southeast. This landscape of the Custer Gallatin National Forest is a hotspot for biodiversity, with all native species present, including the threatened grizzly bear and Canada lynx, as well as other notable species such as wolverines, wild bison, bald eagles, gray wolves, and bighorn sheep.

Bridger, Bangtail, and Crazy Mountains

The Bridger, Bangtail, and Crazy Mountain landscape is also part of the Montane Ecosystem. It is located north of, and separated from the other Custer Gallatin National Forest landscapes by Interstate 90. This landscape accounts for about 9 percent of the Custer Gallatin National Forest plan area. It contains no designated wilderness, but is about 40 percent inventoried roadless area and 60 percent outside of designated areas. Highway 86 separates the Bridger Range from the Bangtails, while Highway 89 and the Shields River valley separates the Bangtails from the Crazy Mountains. This landscape contains a high level of wildlife diversity, including most native species. However, notably missing from this landscape are bison, bighorn sheep, and grizzly bears. A remarkable feature of this landscape is the Bridger Mountain Migratory Flyway, which hosts between 2,000 and 3,500 migrating raptors each fall, including the largest known concentration of migrating golden eagles in the continental United States (Eberly et al. 2016). This landscape also provides a potential corridor of mountainous Federal land, which may facilitate wildlife movement between the Greater Yellowstone Area and other large contiguous blocks of wildlife habitat to the north, such as the Northern Continental Divide Ecosystem in northwest Montana.

Pryor Mountains

The Pryor Mountain landscape, which is the easternmost in the Montane Ecosystem, is a relatively small landscape at only about 2 percent of the Custer Gallatin National Forest plan area. About 13 percent of the Pryor landscape is within inventoried roadless areas, with the rest (87 percent) outside of designated areas. This landscape also supports a richness of native species with the exception of bison, bighorn sheep and grizzly bears, similar to the Bridger/Bangtail/Crazy landscape. While it may be missing a few of the native charismatic megafauna, the Pryor landscape is unique in that it supports the only population of “wild” (feral) horses in the plan area. The Pryor landscape represents somewhat of a transition from the Montane to the Pine Savanna Ecosystem, and as such, also contains a few notable species such as the Eastern red bat (*Lasiurus borealis*), greater sage-grouse (*Centrocercus urophasianus*) and prairie vole (*Microtus ochrogaster*) (Montana Natural Heritage Program database).

Ashland

Ashland, which is east of the Pryor Mountains, is the westernmost landscape of the Pine Savanna Ecosystem. It is one of the largest contiguous blocks of forested public land in eastern Montana, and constitutes roughly 15 percent of the Custer Gallatin National Forest plan area. The Ashland landscape has no designated wilderness, but about 8 percent of the landscape is in inventoried roadless areas, leaving 92 percent of the Ashland landscape outside of designated areas. The Ashland landscape has been hugely impacted by wildfires in recent years. In 2012 alone, about a third of this landscape burned in the Ash Creek and Taylor Creek Fires. Previous fires, dating back to the mid-1990s burned roughly another third of the Ashland District, including some areas that burned again in 2012. In total, nearly 60 percent of the Ashland landscape has been affected by large fires since 1995. These recent, large fires have changed the amount and distribution of forest cover across the landscape, reducing the proportion of forest cover from approximately 40 percent in 1995 to about 25 percent today (USDA Forest Service 2014). This change in forest/grassland ratio has likely influenced wildlife species diversity, abundance, and distribution. For example, the Ashland landscape has one of the fastest growing elk herds in the state of Montana. In 2004, the Montana Fish Wildlife and Parks population objective for the Ashland elk herd was 500 animals. This herd is now at about 1,000 elk (DeVore, R., 2016, personal communication). Recent fires have also produced notable gains in habitat for snag-associated species like woodpeckers.

Sioux

The Sioux landscape in the Pine Savanna Ecosystem, which represents the easternmost part of the Custer Gallatin National Forest, is only about 5 percent of the plan area, and is almost 100 percent outside of designated areas, although there are two National Natural Landmarks totaling about 1,250 acres. This landscape contains eight distinct units, three of which are in Montana, with the other five just across the border in the northwestern corner of South Dakota. The South Dakota units cover only about 2 percent of the Custer Gallatin National Forest plan area. The Sioux landscape units are all separated by lowlands that are mostly in private ownership. These lowlands are dominated by ranchland and agricultural use, but contain native grasslands as well. The individual units of the Sioux landscape are also separated by state highways, including Highways 323 and 328 in Montana as well as Highways 20, 85 and 79 in South Dakota. A number of wide-ranging species that have been rare, or absent from the Sioux landscape for decades, have been observed the area in recent years. These native, but relative new-comers to the area include elk, moose, black bear, and mountain lion.

Key Benefits to People

Wildlife and habitat on the Custer Gallatin National Forest have a great many social, economic, recreational, spiritual and scientific benefits to people. Hunting and trapping of wildlife are extractive uses with a strong tradition in the western culture, as well as a major economic driver in western states. Viewing and photography of wildlife are non-extractive uses that also contribute greatly to local, national, and even international economies. Literally millions of people travel to this region annually to visit the area (many come to visit Yellowstone National Park, but extend their visit to the Custer Gallatin National Forest as well). These visitors come for a variety of reasons, but the chance to see wildlife is generally at least on the list, if not the highest priority. In addition to recreational pursuits, there are many wildlife-related jobs in communities associated with the plan area, including both technical and professional careers for biologists, managers, researchers and advocates, as well as wildlife-related vocations in the recreation industry, such as outfitters, guides, taxidermists, writers, artists, photographers, and film-makers. Because of the incredible wildlife diversity, and presence of rare species in this area, the wildlife resource is nationally and internationally recognized and cherished, attracting the attention of wildlife professionals and advocates world-wide. Since many of the key benefits the Custer Gallatin National Forest wildlife resource has to offer are related to recreational pursuits, additional information can be found in the Recreation, Social and Economic specialist reports.

Risks and Stressors

Wildlife and wildlife habitat are highly valued resources on the Custer Gallatin National Forest. However, differing social values can sometimes lead to conflicts associated with the wildlife resource. For example, the presence of sensitive wildlife species and/or habitats may require limits or restrictions imposed on certain types of management activities and recreational activities. Wildlife can have negative impacts on adjacent land owners through property damage. For example, native ungulates can cause economic hardships to ranchers by consuming forage meant for livestock. Large animals like bison or moose can break down fences and damage other property. Bears may break into storage facilities in search of food. Predators are sometimes considered a threat to livestock and pets, as well as competition for big game with human hunters. Furthermore, many wildlife species can cause serious bodily injury, or even death to humans.

Trends and Drivers

Natural and man-caused disturbances have had major impacts on wildlife habitat. Natural ecological processes including drought, fire, wind, floods, insects and disease, all shape the character of wildlife habitat, often by converting older forest to early-seral stages at a variety of scales. Natural succession, or vegetation growth over time, also plays a role. Wildlife have adapted to these natural disturbance and succession processes for millennia, resulting in high biodiversity as different species have come to use a variety of plant community types across a range of structural stages to meet their life cycle requirements. Natural disturbance processes are dynamic, and generally produce temporary changes on the landscape. Some human-caused disturbance, such as timber harvest and prescribed fire, also have temporary impacts on habitat, while others, such as road-building, agricultural conversion, dam-building, and residential/recreational developments, alter habitat in more permanent ways, often reducing or eliminating habitat suitability for many wildlife species, as well as creating barriers to wildlife movement across the landscape. Human influence is also a factor in the introduction and spread of exotic plant and animal species into native habitats, which can cause permanent habitat alterations, as well as impact native fauna through competition, disease, parasitism and/or predation. Human activities not only have the potential to alter wildlife habitat, but disturbance effects from noise associated with human presence can also affect wildlife habitat use. Land ownership patterns have also changed over time. Notably, previously checkerboard land patterns on the western side of the plan area were consolidated into larger blocks of public and private land in the 1990s under a congressional mandate. Trends and drivers specific to individual species are described in subsequent sections of this assessment.

Climate change is expected to be a major driver of wildlife habitat conditions in the future, with generally warming trends anticipated within the plan area and surrounding landscapes. Predicted climate change effects on the landscape are somewhat speculative and variable depending on parameters used and assumptions made in estimations. Potential impacts to terrestrial wildlife in the plan area may result from changes in:

- The timing, amount, and consistency of snow and other precipitation;
- Vegetation communities and structure;
- The timing, frequency, and severity of storms;
- Fire severity and size; and
- Predator-prey relationships and associated effects on trophic structure.

While there is significant evidence that climate change is occurring, will continue to occur, and will have ongoing impacts to wildlife habitat, the resulting conditions and associated effects to species will no doubt be complex and difficult to predict. This is because there is a general lack of understanding regarding the specific physiological and behavioral sensitivity to climatic conditions for most species (McKelvey and Buotte 2016). Where information is available, potential climate change impacts will be addressed for individual species in following sections.

Information Needs

Wild animals are mobile, wary, and often actively avoid humans. Therefore, it can be difficult to locate and study individuals, let alone obtain meaningful scientific information for entire populations. Population trend information is extremely difficult to obtain, because it requires data for at least a reasonable reference set of individuals, including information on survival and reproduction rates, as well as immigration and dispersal. Considering the large number of wildlife species inhabiting the plan area for at least part of their life cycle, there is limited scientific information on biology, ecology, and population trends for the majority of species present. Some species are more rare and/or associated with remote, rugged environments, or are present here for a relatively short time before moving elsewhere, making detection and observation even more difficult.

Habitat, on the other hand, is generally stationary, and can be readily surveyed, monitored, and/or studied over time. However, the large geographic extent and wide range of habitat diversity within the plan area generates significant complexity for research and monitoring purposes. Research and monitoring efforts occur within the plan area, but are often limited by funding and related resource availability. At the time this assessment was conducted, summary data were lacking for long-term examination of habitat conditions and changes over time. Custer Gallatin National Forest personnel are in the process of developing such data through modeling efforts, in order to predict the natural range of variation that has occurred within and between key ecosystem characteristics over time. Such information will be used to inform the forest plan revision process. Currently, uncertainty exists regarding the direct, indirect, and cumulative impacts of various and collective management activities on individual animals, habitat, and wildlife populations. Further, the science surrounding climate change is currently limited. While there is an appreciable body of science on the topic, and this information is growing, there is still much ambiguity and scientific disagreement on not only the potential impacts to habitat, but how such impacts might affect wildlife populations. Additional details about information gaps are provided in following sections for individual species.

Key Findings

Wildlife habitats within the plan area are largely intact, although there have been notable impacts to certain types, such as whitebark pine. Resulting impacts to wildlife species are not entirely known.

Most species that were present in the plan area prior to European settlement are still present today. While distribution of some notable species such as bison, wolves, and grizzly bears may be more limited than it was in pre-settlement times, distribution of these species has increased notably in the plan area during the past few decades (under management direction contained in existing plans).

The Custer Gallatin National Forest supports a high level of terrestrial and aquatic species diversity, with well over 600 species known to occur within the plan area for at least a portion of their life cycle.

The broad-scale diversity across the plan area (Pine Savanna and Montane Ecosystems), combined with fine scale diversity (variation in elevation, aspect, slope, vegetation communities and successional stages), is necessary to sustain the high level of existing species diversity.

Terrestrial wildlife and the ecological processes that shape habitats operate across a range of temporal and spatial scales, often at scales larger than the plan area, which necessitates coordination across boundaries and jurisdictions.

Facilitating wildlife movement within and between Custer Gallatin National Forest administrative areas, as well as between the Custer Gallatin National Forest and other key ecological areas, is essential to habitat and species conservation.

The findings of this assessment suggest that existing plans are generally adequate to manage wildlife habitats for healthy populations. However, the prescriptive nature of existing plans (mandates to use specific methods, processes and/or techniques) can become problematic as information, science, and technology changes over time.

At-Risk Species: Threatened, Endangered, Proposed and Candidate Species

Grizzly Bear *(Ursus arctos)*: Threatened

Introduction

The grizzly bear was listed as a threatened species under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531), in the lower 48 states in 1975 (40 Federal Register 1975:31736). The Grizzly Bear Recovery Plan (USDI Fish and Wildlife Service 1982, revised 1993) delineated grizzly bear recovery zones in six mountainous ecosystems in the United States, including the Greater Yellowstone Ecosystem. Grizzly bears that occur in the plan area are part of the Greater Yellowstone Ecosystem population. The Greater Yellowstone Ecosystem Grizzly Bear Recovery Zone covers parts of Montana, Idaho, and Wyoming, and includes portions of five national forests (including the Custer Gallatin), two national parks, state and private lands, and lands managed by the BLM. Grizzly bears also frequently use areas outside the designated recovery zone.

The Greater Yellowstone Ecosystem grizzly bear population met stated recovery objectives by early 21st century. Consequently the U.S. Fish and Wildlife Service published a final rule designating Greater

Yellowstone Ecosystem grizzlies as a distinct population segment and removing this segment from the list of threatened and endangered species in March 2007. However, a Montana District Court order vacated the delisting and remanded the decision back to the U.S. Fish and Wildlife Service. Therefore, as of the date of the District Court decision (September 21, 2009) Greater Yellowstone Ecosystem grizzly bears were again listed as threatened under the Endangered Species Act. In March 2016, the U.S. Fish and Wildlife Service published a new proposal to delist the Greater Yellowstone Ecosystem grizzly bear distinct population segment, based upon the best available scientific and commercial information (USDI Fish and Wildlife Service 2016). Concurrently, land and wildlife management agencies began the process of updating the Greater Yellowstone Ecosystem Grizzly Bear Conservation Strategy, to ensure that adequate regulatory mechanisms are in place, and are based upon the best available scientific information to facilitate the delisting process. Until such time as the Conservation Strategy is finalized, and the U.S. Fish and Wildlife Service publishes a final rule delisting the Greater Yellowstone Ecosystem grizzly bear population, the species remains federally listed as threatened.

Process and Methods

The best available scientific information for the plan area and surrounding landscape were used to inform this assessment. Members of the Interagency Grizzly Bear Study Team based in Bozeman, Montana, were consulted for insight, as well as literature recommendations to consider for this assessment. In addition to information relevant to the Greater Yellowstone Ecosystem grizzly bear population as a whole, this assessment provides findings specific to the Custer Gallatin National Forest plan area. GIS technology and the Greater Yellowstone Ecosystem Grizzly Bear Access Model were used to quantify and display information pertinent to this assessment, such as secure habitat and grizzly bear distribution trends.

Scale

There are a number of geographic scales relevant to grizzly bear use of the plan area. The Greater Yellowstone Ecosystem for grizzly bears covers about 34,750 square miles in parts of Idaho, Montana, and Wyoming (USDI Fish and Wildlife Service 2016:13226). Just over half of the Greater Yellowstone Ecosystem (17,774 square miles) has been identified as suitable habitat for grizzly bears, and grizzly bears currently occupy over 90 percent of the suitable habitat (USDI Fish and Wildlife Service 2016:13186). The grizzly bear recovery zone is at the core of the suitable habitat in the Greater Yellowstone Ecosystem, covering an area of about 9,200 square miles including Yellowstone and Grand Teton National Parks and parts of five surrounding national forests, including the Custer Gallatin. All of the currently occupied habitat on the Custer Gallatin National Forest is in the Madison/Gallatin/Absaroka-Beartooth landscape area. This landscape is roughly 3,662 square miles in size, of which about 1,600 square miles (44 percent) is inside the recovery zone and 2,062 square miles (56 percent) is outside the recovery zone but within suitable habitat. Notably, the Custer Gallatin National Forest administers nearly 20 percent of the total suitable habitat identified for Greater Yellowstone Ecosystem grizzly bears, including approximately 17 percent of the area within the recovery zone.

Within the Greater Yellowstone Ecosystem grizzly bear recovery zone, agencies delineated 18 bear management units to facilitate the assessment of habitat characteristics and recovery objectives. Bear management units represent the spatial scale of the life range for a female grizzly bear in the Greater Yellowstone Ecosystem. Bear management units are further divided into 40 subunits (bear management subunits), which provide additional landscape resolution to account for seasonal differences in grizzly bear use patterns within a bear management unit (USDI Fish and Wildlife Service 2016:13182). The Custer Gallatin National Forest intersects 9 of the 18 bear management units and 14 of the 40 subunits inside the recovery zone. Bear management units that include portions of the Custer Gallatin National Forest average about 482 square miles in size, and the average size of subunits intersecting the Custer Gallatin National Forest is 217 square miles. Outside the recovery zone, bear analysis units were developed to provide consistent analysis units for monitoring changes to grizzly bear habitat, and are roughly the size of bear management subunits inside the recovery zone (Schwartz et al. 2009). There are 8 bear analysis units on the Custer Gallatin National Forest within the Greater Yellowstone Ecosystem suitable habitat areas, plus three outliers, which were identified in areas that may provide habitat connectivity between the Greater Yellowstone Ecosystem and other grizzly bear ecosystems.

Existing Information

The Interagency Grizzly Bear Study Team consists of interdisciplinary scientists, biologists and managers tasked with long-term monitoring and research efforts on grizzly bears in the Greater Yellowstone Ecosystem. The Team has been conducting research since 1973, making the Greater Yellowstone Ecosystem the most studied population of grizzly bears anywhere in the world (USDI Fish and Wildlife Service 2016). Because of the notoriety of the Greater Yellowstone Ecosystem grizzly bear population, there is a wealth of scientific information available regarding the population, distribution, habitat needs, and potential threats to this species. The March 2016 U.S. Fish and Wildlife Service Proposed Rule to delist the Greater Yellowstone Ecosystem grizzly bear distinct population segment provides an excellent summary of this information, and was one of many sources used in this assessment. A Conservation Strategy for the Grizzly Bear in the Yellowstone Ecosystem was completed in 2003, and later revised (Interagency Conservation Strategy Team 2007). The conservation strategy was developed by an interagency team consisting of representatives from the Interagency Grizzly Bear Study Team, National Park Service, U.S. Forest Service, U.S. Fish and Wildlife Service, and State wildlife management agencies. This team brought a wealth of knowledge and experience to the table, and developed the conservation strategy using their combined expertise, as well as drawing on the best available scientific research relative to grizzly bear conservation and management. The conservation strategy is currently (2016) being revised to incorporate new science and information gained since 2007.

Current Forest Plan Direction

The Gallatin Forest Plan, which dictates management for the majority of grizzly bear habitat on the Custer Gallatin National Forest, includes management direction designed specifically for grizzly bear habitat conservation and recovery of the species. There are Custer Gallatin-wide, as well as management area-specific goals, objectives, standards and guidelines for grizzly bear management in the forest plan. The Gallatin Forest Plan contains Forestwide goals and objectives to manage for grizzly bear recovery and prevent human-caused grizzly bear losses. Because the original (1987) Gallatin Forest Plan was quite outdated, including stale direction for grizzly bear habitat management, an extensive update was made (hereafter referred to as “the cleanup amendment”). A major premise of the cleanup for grizzly bear was to replace outdated information and interim direction contained in the plan with new direction based on the current best science contained in the Greater Yellowstone Ecosystem Grizzly Bear Conservation Strategy (ICST 2007), which is consistent with current information in the Grizzly Bear Recovery Plan (USDI Fish and Wildlife Service 2007). The cleanup amendment record of decision was signed, and the new direction became effective, in November 2015.

The cleanup amendment formally adopted into the Gallatin Forest Plan, standards for managing grizzly bear habitat related to human access and land uses, and monitoring requirements to track grizzly bear/human conflicts and associated grizzly bear mortalities. Standards adopted from the conservation strategy apply within the grizzly bear recovery zone, and basically serve to maintain or improve grizzly bear habitat conditions relative to the way things were in 1998. Under the conservation strategy, the year 1998 was selected as a baseline for measuring grizzly bear habitat metrics, because habitat conditions leading up to that time provided an environment that resulted in growth of the grizzly bear population and subsequent achievement of all demographic recovery targets by 1998 (ICST 2007).

There are currently no standards or guidelines that apply specifically to grizzly bear habitat management outside the recovery zone. However, the Gallatin National Forest Travel Management Plan (USDA Forest Service 2006) provides direction pertaining to access management, both within and outside the recovery zone.

The Custer Forest Plan contains broad direction to coordinate land management uses with grizzly bear habitat needs and avoid conflicts. Most of the standards for managing land uses consistent with grizzly bear habitat conservation specify that activities are to follow direction contained in the publication "Guidelines for Managing Grizzly Bears in the Greater Yellowstone Area" and cite to a 1979 Forest Service publication. Although these 1979 guidelines are seriously outdated, there were few management implications, since grizzly bear sightings were a rare occurrence on the Custer National Forest when the Plan was written, and remained so until recently (see Figure 3 and Figure 4 for changes in grizzly bear distribution over time).

As mentioned above, the Greater Yellowstone Ecosystem grizzly bear population met demographic recovery targets by 1998, and has generally sustained or exceeded targets since. As a result, the U.S. Fish and Wildlife Service removed the Greater Yellowstone Ecosystem grizzly bear population from the list of threatened and endangered species in March 2007. To facilitate the delisting, the Federal land management agencies developed the Greater Yellowstone Ecosystem Grizzly Bear Conservation Strategy (Interagency Conservation Strategy Team 2007), which provided the regulatory mechanisms required for delisted species under the Endangered Species Act. As a result, both the Custer and the Gallatin amended their Forest Plans in 2006 to formally adopt the direction in the conservation strategy (Custer Plan Amendment No. 42; Gallatin Forest Plan Amendment No. 27). However, since the function of a conservation strategy is to provide regulatory mechanisms for delisted species, the language in the forest plan amendments specified that the direction applied to a delisted population of grizzly bears. In 2009, a Montana District Court order vacated the delisting and remanded the decision back to the U.S. Fish and Wildlife Service, returning the Greater Yellowstone Ecosystem grizzly bear population to threatened status, and essentially nullifying the 2006 Forest Plan amendments adopting conservation strategy recommendations as Forest management direction. Therefore, the Custer Forest Plan direction for grizzly bear habitat management is still outdated and in need of modification, whereas the 2015 Gallatin Forest Plan (Amendment No. 51) formally adopted the conservation strategy guidance as direction, regardless of the status of the species under the Endangered Species Act.

Of the area covered by the Custer Forest Plan, only the Beartooth Ranger District contains suitable grizzly bear habitat. The District completed a travel management plan in June 2008, when the Greater Yellowstone Ecosystem grizzly bear population was delisted, so there is no specific direction pertaining to grizzly bear habitat management in the Beartooth District Travel Plan. However, like the Gallatin Forest Travel Management Plan, the Beartooth Travel Plan contains management direction for human access, both within and outside of the grizzly bear recovery zone.

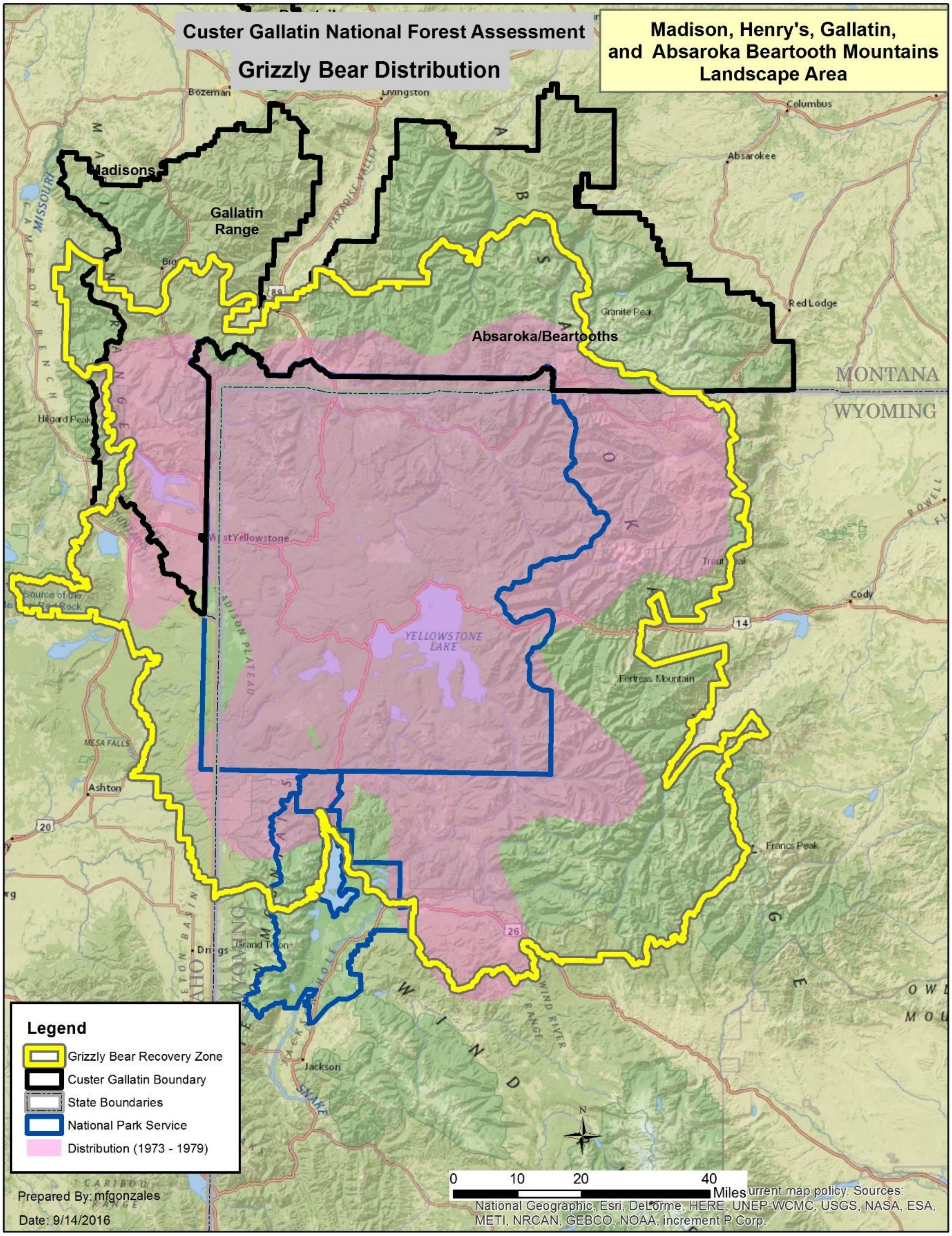

Figure 3. Grizzly Bear distribution, 1973–1979

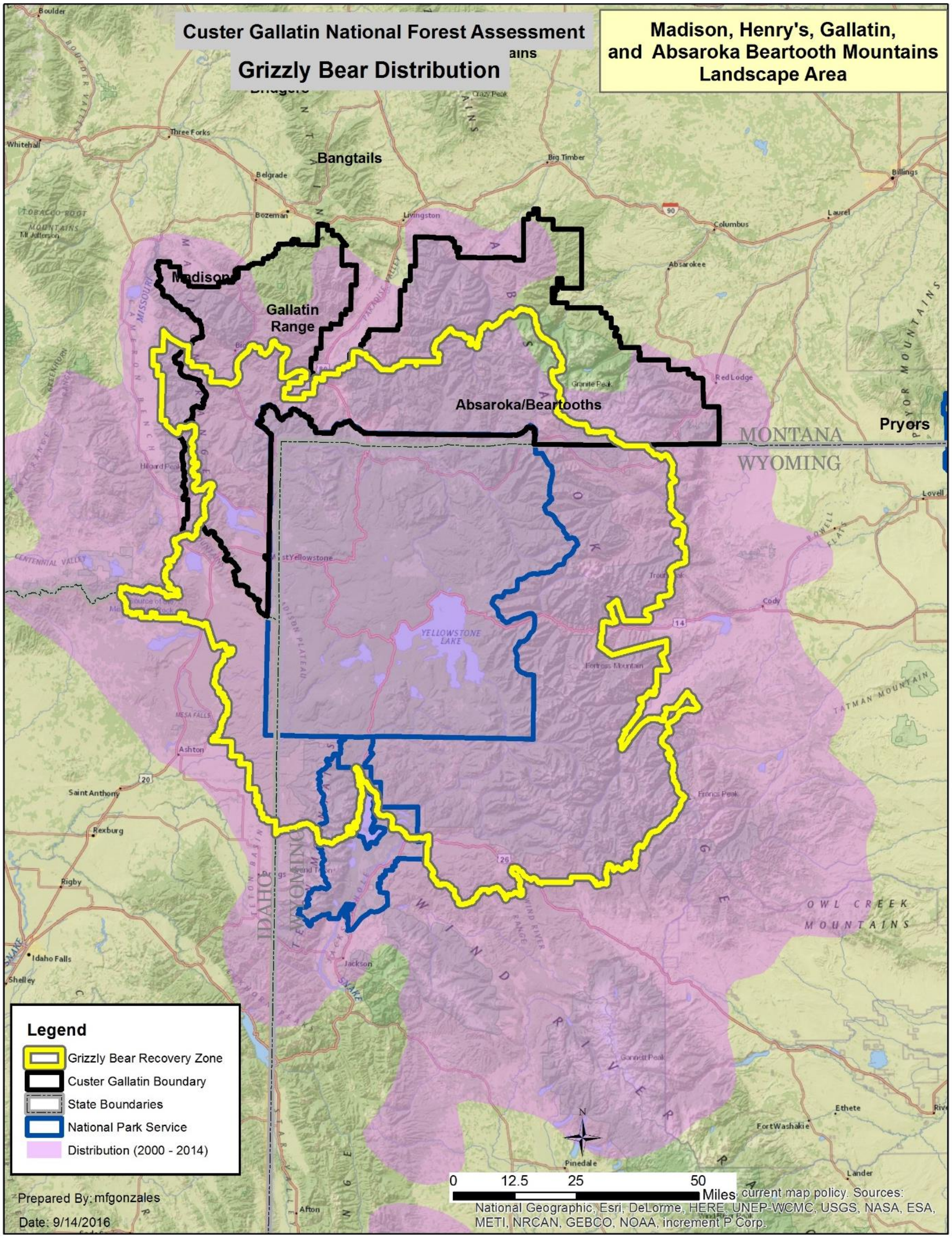

Figure 4. Grizzly Bear distribution, 2000–2014

Existing Condition

The Greater Yellowstone Ecosystem grizzly bear population is currently estimated at well over 700 bears. The population appears stable (not in decline) and has potentially reached carrying capacity (Interagency Grizzly Bear Study Team 2013). Although there is no estimate of the number of grizzly bears within the Custer Gallatin National Forest plan area, grizzly bears are present and well-distributed in the western part of the plan area. They currently occupy most suitable habitat in the plan area south of Interstate 90 and west of Montana Highway 212 (see Figure 4 for current grizzly bear distribution).

Observations of reproductive female grizzlies (females with offspring) are monitored by the Interagency Grizzly Bear Study Team as indicators of population health. The Grizzly Bear Recovery Plan (USDI Fish and Wildlife Service 1993, 2007) includes a requirement that 16 of 18 bear management units must be occupied by reproductive female grizzlies on a 6-year-running average. This criteria has been met for the Greater Yellowstone Ecosystem. The Custer Gallatin National Forest includes parts of 9 out of 18 bear management units. Females with young have been observed in 8 of the 9 bear management units intersecting the plan area for 6 years in a row. The one remaining bear management unit intersecting the plan area has been occupied by females with young for 5 of the past 6 years (van Manen et al. 2015). In other words, reproductive grizzly bears are well distributed among the bear management units within the plan area.

Grizzly bears are habitat generalists that employ an opportunistic, omnivorous foraging strategy by utilizing a wide range of plant and animal food sources (Gunther et al. 2014). Dietary and habitat plasticity are fundamental to the evolutionary strategy of brown bears (*Ursus arctos*) in general, and may be the reason they occupy the most diverse habitat of any bear species in the world (Interagency Grizzly Bear Study Team 2013). Although Greater Yellowstone Ecosystem grizzly bears exhibit a high level of dietary variation, the Interagency Grizzly Bear Study Team has identified four key food sources, which are monitored annually. These include: ungulate biomass (obtained through direct predation as well as carcass scavenging), spawning cutthroat trout (*Oncorhynchus clarkia*), whitebark pine (*Pinus albicaulis*) seeds, and army cutworm moths (*Euxoa auxiliaris*). These four food types are important to Greater Yellowstone Ecosystem grizzly bears because they are easily digestible and provide high concentrations of protein and/or fats, which in turn deliver energy and nutrients (Schwartz et al. 2010; van Manen et al. 2015; and Costello et al. 2016).

Ungulate biomass is readily available within the plan area, due to the presence of large herds of elk (*Cervus elaphus*), which are well-distributed across the plan area, as well as mule deer (*Odocoileus hemionus*) and moose (*Alces alces*), which are less abundant than elk, but still well distributed. Bison (*Bison bison*) are also present in areas near Gardiner and West Yellowstone, whereas white-tailed deer (*Odocoileus virginianus*) and antelope (*Antilocapra americana*) are present at lower elevations in the plan area relative to grizzly distribution. Grizzly bears obtain ungulate biomass from scavenging carcasses, primarily on winter ranges, as well as direct predation, generally of young (calves and fawns) animals. They also may obtain ungulate carcasses by taking fresh kills from other predators such as wolves (*Canis lupus*) and mountain lions (*Felis concolor*). Grizzly bears are also known to utilize ungulate biomass left by big game hunters, in the form of gut piles and/or hunter-wounded animals that are not retrieved. Occasionally, grizzly bears claim carcasses of big game animals killed by hunters, which can lead to bear-human conflicts that may result in injury or death of either bears or humans (Ebinger et al. 2016).

Whitebark pine is a masting species that is cyclic, producing a large seed crop every 2 to 3 years (Schwartz et al. 2014). The seeds of whitebark pine are large relative to other tree species, and when abundant, provide a highly valuable food source for grizzly bears. The importance of whitebark pine as a key food source for Greater Yellowstone Ecosystem grizzly bears has been a topic of high notoriety (Interagency Grizzly Bear Study Team 2013; Schwartz et al. 2014; Gunther et al. 2014; Costello et al. 2014; Ebinger et al. 2016; USDI Fish and Wildlife Service 2016). Whitebark pine seeds mature late-summer to fall. Consequently, this food is most commonly consumed by bears in September and October. Because whitebark pine grows at high elevations (roughly 8,200 feet and above) and fairly remote environments, it typically occurs in areas that are relatively secure from human influence. In years of poor cone/seed production, grizzly bears seek out alternate food sources, which may cause them to increase foraging frequency in areas of higher human influence. Higher rates of bear-human conflicts have been correlated with poor whitebark seed production years (Schwartz et al. 2010; 2014). Whitebark pine has been notably impacted within the Greater Yellowstone Ecosystem including the plan area, in recent years, primarily due to infestation by mountain pine beetle (*Dendroctonus ponderosae*) and, to a lesser degree from invasion of an exotic fungus (*Cronartium ribicola*) that causes white pine blister rust. However, there is evidence that whitebark mortality levels may be diminishing (Schwartz et al. 2014). More information about whitebark pine habitat can be found in the Vegetation specialist report. Further details about trends in whitebark pine production relative to grizzly bear use are included under the following “Trends and Drivers” section

Grizzly bear use of spawning trout in the Greater Yellowstone Ecosystem has been primarily associated with tributaries of Yellowstone Lake (van Manen et al. 2015). Fish spawning areas are not known to be an important food resource for grizzly bears within the Custer Gallatin National Forest Plan area. Likewise, grizzly bear use of army cutworm moths has been documented on the east side of the Greater Yellowstone Ecosystem, but is not known to be a factor within the plan area.

The four key foods for Greater Yellowstone Ecosystem grizzly bears, two of which are present and well-distributed within the plan area where grizzly bears occur, continue to be of high importance for bears. However, these food sources are not evenly available on a spatial or temporal scale; that is, not all high-calorie, energy-rich foods are available to all grizzly bears across the Greater Yellowstone Ecosystem, nor are these foods available in sufficient and/or predictable amounts to support all bears from year to year. That is why the highly adaptable foraging strategy of grizzly bears serves the species so well. In geographic areas or during times of low availability of the easily accessible, high-energy food sources, grizzly bears shift their attention to a wide range of alternate food sources that are of lower caloric value, but tend to be more readily available across the landscape (Gunther et al. 2014).

Within the plan area, whitebark pine and ungulate biomass (key foods) are present and well distributed, but like the rest of the Greater Yellowstone Ecosystem, the availability of these foods varies geographically and temporally within the plan area. However, the broad diversity of habitat types within the plan area occupied by grizzlies provides a wide variety of alternate foods for bears to supplement their diet when key foods are less, or unavailable. Gunther and others (2014) documented 266 species of plant, animal, fungi, algae and soil consumed by grizzly bears in the Greater Yellowstone Ecosystem. Some of these food items were incidental, and believed to be consumed through exploratory behavior or accidentally during consumption of other foods. The most frequent food items found in the grizzly bear’s diet include grasses, ants (*Formicidae* spp.), whitebark pine seeds, clover (*Trifolium* spp.) and dandelion (*Taraxacum* spp.), all of which are present and widely distributed across the plan area. Although berries are noted in the Greater Yellowstone Ecosystem grizzly bear diet (Gunther et al. 2014; Costello et al. 2016), the Greater Yellowstone Ecosystem differs from other grizzly bear ecosystems because of the lower proportion of berry-producing shrubs and relatively large populations of wild ungulates (Ebinger et al. 2016). This condition is reflective of the plan area as well.

Grizzly bears are definitely habitat generalists in terms of finding adequate resources for food, water and shelter. Therefore of primary concern for grizzly bear habitat management is the potential for conflicts with humans. Schwartz and others (2010) stated that “humans are the primary agent of death for grizzly bears”, and noted that human-caused grizzly bear mortalities are major drivers of grizzly bear population trends. The Interagency Grizzly Bear Committee (1994, revised 1998) recognized the impacts of human access on grizzly bear habitat security. Specifically, motorized access has been shown to increase human interaction with bears and potentially increase associated grizzly bear mortality risk, increase grizzly bear displacement from important habitats, increase bear habituation to human presence, and reduce habitat security. Secure areas are a major component of grizzly bear habitat, as they provide opportunities for bears to meet energetic needs with low potential for disturbance from human intrusions (USDI Fish and Wildlife Service 2016). Secure habitat for Greater Yellowstone Ecosystem grizzly bears is defined as those areas at least 4.05 hectares (10 acres) in size, that are at least 500 meters (0.3 mile) away from open or gated motorized access routes (Schwartz et al. 2010; Interagency Grizzly Bear Study Team 2013; Costello et al. 2014, USDI Fish and Wildlife Service 2016).

Within the Greater Yellowstone Ecosystem recovery zone, secure habitat levels are generally high, but range from 46 percent to 100 percent of individual bear management subunits. Collectively, the entire recovery zone is about 87 percent secure habitat (Landenburger *in:* van Manen et al. 2015). Subunits that fall within the Custer Gallatin National Forest plan area are within that range, with a low of 51 percent and high of 99.6 percent secure. Table 2 shows that secure habitat levels have increased for nearly all bear management subunits that are at least partially within the plan area.

Table 2. Secure habitat for Custer Gallatin Bear Management Subunits, 1998 and 2014

Bear Management Subunit Name and Number	Size Square Miles	Percent Secure 1998	Percent Secure 2014	Change
Boulder/Slough 1	282	96.6	97.1	+1.1
Boulder/Slough 2	232	97.7	97.7	=0.0
Crandall Sunlight 1	130	81.1	81.9	+0.8
Crandall Sunlight 2	316	82.3	82.7	+0.4
Gallatin 3	218	55.2	72.0	+16.8
Hellroaring/Bear 1	185	77.0	80.6	+3.6
Hellroaring/Bear 2	229	99.5	99.6	+0.1
Henrys Lake 2	140	45.7	51.5	+5.8
Hilgard 1	201	69.8	83.1	+13.3
Hilgard 2	141	71.4	80.2	+8.8
Lamar 1	300	89.4	89.9	+0.5
Madison 1	228	71.5	80.7	+9.2
Madison 2	149	66.5	67.5	+1.0
Plateau 1	286	68.8	70.6	+1.8

Secure habitat is monitored by bear management subunits because subunits are delineated based on features that are biologically meaningful to bears. Therefore, subunits tend to overlap administrative boundaries, as is the case on the Custer Gallatin National Forest (Figure 5). Of the 14 bear management subunits that fall within the Custer Gallatin National Forest boundary, only one, Boulder Slough 1, is entirely within the plan area; all others are shared with at least one other administrative unit (other national forests and/or Yellowstone National Park). Considering only Custer Gallatin National Forest portions of subunits, the area inside the recovery zone within the plan area is approximately 79 percent secure.

Grizzly bears are known to frequent suitable habitat outside the recovery zone as well. Areas outside the recovery zone are important to bears in that they allow for population expansion, and provide additional habitat for ecological resiliency, which presents options for grizzly bear responses to changing environmental conditions. The U.S. Fish and Wildlife Service estimates about 60 percent of the suitable habitat outside the recovery zone is secure. Considering only National Forest System lands, the amount of secure habitat outside the recovery zone in the distinct population segment is roughly 71 percent, based on the amount of wilderness, wilderness study areas, and inventoried roadless areas (USDI Fish and Wildlife Service 2016). Within the Custer Gallatin National Forest plan area, wilderness, wilderness study areas, and inventoried roadless areas account for approximately 73 percent of the suitable habitat for grizzly bears outside the recovery zone.

Federally designated areas such as wilderness, wilderness study areas, and inventoried roadless areas contain restrictions on land uses that create relatively secure habitat for grizzly bears. However, these designated areas are not strictly equivalent to the accepted definition of secure habitat for grizzly bears in the Greater Yellowstone Ecosystem; i.e., those areas at least 4.05 hectares (10 acres) in size, that are at least 500 meters (0.3 mile) away from open or gated motorized access routes as described above. This is because there are some, although few, motorized routes in wilderness study areas and inventoried roadless areas. The Interagency Grizzly Bear Study Team monitors habitat conditions outside the recovery zone every 2 years using 2008 as a baseline, which in the first year there was a reliable dataset for motorized access routes outside the recovery zone (Schwartz et al. 2009). This information is reported out by bear analysis unit. The 2014 Interagency Grizzly Bear Study Team Annual Report shows secure habitat (using the accepted definition) outside the recovery zone to be 71 percent within the Custer Gallatin National Forest plan area. However, the Interagency Grizzly Bear Study Team monitors secure habitat in the Pryor Mountain and the Bridger/Bangtail/Crazy Mountain landscapes of the Custer Gallatin National Forest, whereas these areas are not within the suitable habitat depicted by the U.S. Fish and Wildlife Service in their analysis (USDI Fish and Wildlife Service 2016: figure 2, page 13184). Excluding these landscapes from calculations increases the number for the Custer Gallatin National Forest portion to 75 percent secure in suitable habitat outside the recovery zone. Table 3 shows that secure habitat has increased for most bear analysis units within the Custer Gallatin National Forest plan area. Figure 6 shows locations of bear analysis units outside the Greater Yellowstone Ecosystem Bear Recovery Zone.

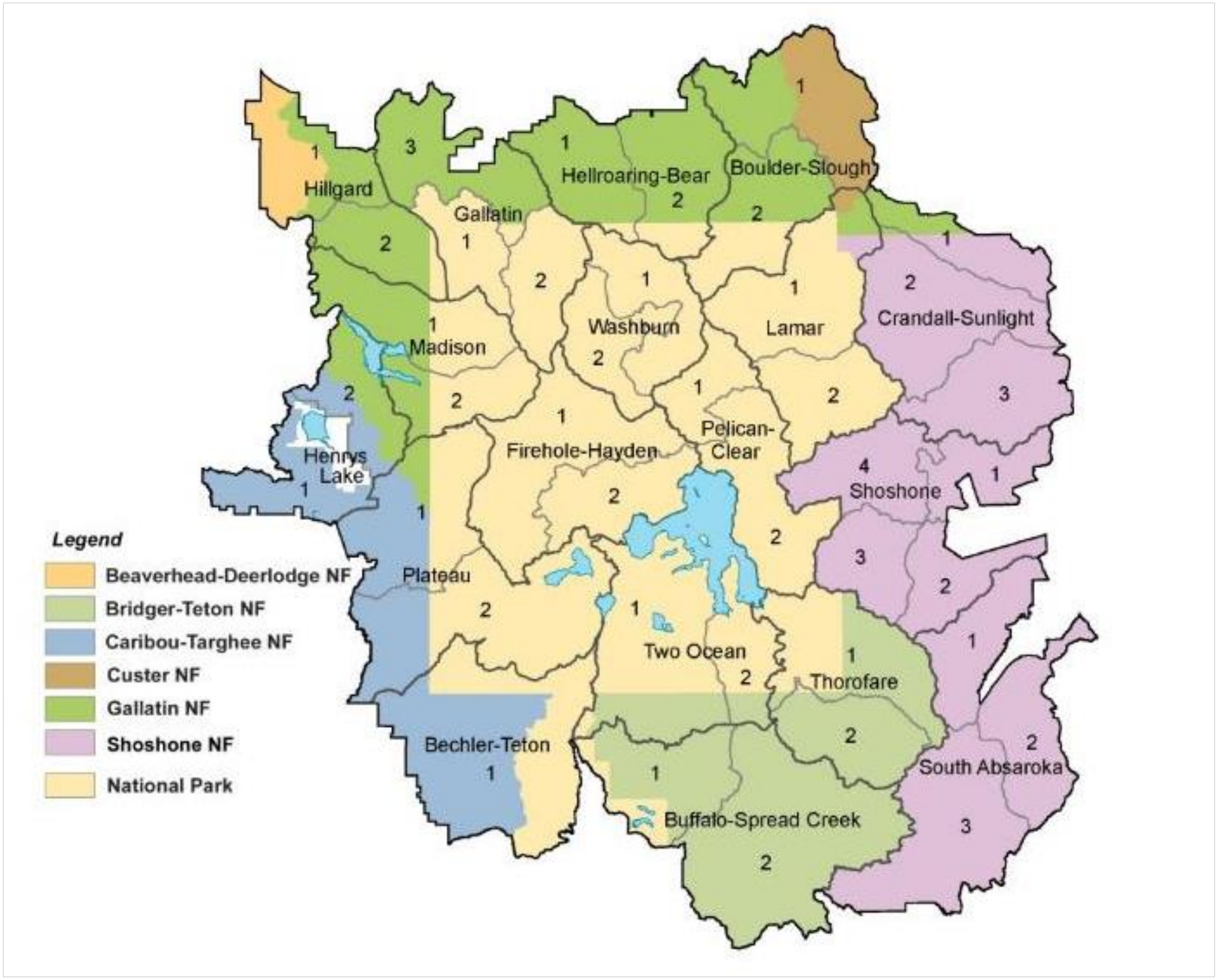

Figure 5. Grizzly bear management units and subunits in the Greater Yellowstone

Table 3. Secure habitat in Custer Gallatin Bear Analysis Units in 2008 and 2014

Bear Analysis Unit	Size Square Miles	Percent Secure 2008	Percent Secure 2014	Change
Boulder	228	64.8	69.9	+5.1
Bozeman	271	45.6	59.4	+13.8
Bridger	236	28.3	38.4	+10.1
Cooke City	69	99.6	99.6	0.0
Crazy	255	57.2	67.6	+10.4
Gallatin	415	52.3	59.4	+7.1
Mill Creek	312	82.3	83.8	+1.5
Pryor Mountains	122	38.8	38.8	0.0
Quake Lake	66	85.0	92.1	+7.1
Rock Creek	237	83.8	83.8	0.0
Stillwater	405	85.3	85.7	+0.4

Schwartz and others (2010) pointed out that secure habitat in the Greater Yellowstone Ecosystem is disproportionately distributed at higher elevations, and noted that some human-caused bear mortalities may be attributed to bears frequenting non-secure habitat at lower elevations where human use tends to be more concentrated. They correlated this phenomenon with poor whitebark pine seed production. Since whitebark pine generally occurs at higher elevations (typically at or above 8,200 feet), it is often found in more secure habitat than bear foods associated with lower elevations. In years of low whitebark seed production, some bears may look for alternate food sources in lower elevation areas, and those that frequent non-secure habitat to do so, have a higher risk of contact with humans, which increases the mortality risk for bears. On the other hand, bears that moved to lower elevations but selected for secure habitat, did not experience the same increase in mortality risk from human conflict. Given this relationship, some research (Schwartz et al. 2010; Costello et al. 2014) has suggested that the indirect benefit Greater Yellowstone Ecosystem bears derive from using whitebark pine as a food source (e.g., remaining in areas of relatively high secure habitat) may be diminished as whitebark pine decline due to mountain pine beetle mortality. However, Costello and others (2014) did not find a distinct relationship between grizzly bear selection for whitebark pine habitat and selection for secure habitat. In other words, they found that bears were not forced into less secure habitat as a result of lower whitebark pine seed availability. Within the entire Custer Gallatin National Forest plan area (both within and outside the recovery zone) suitable habitat is about 77 percent secure. Most (59 percent) of the secure habitat in the plan area is at or above 8,200 feet elevation, or within the whitebark pine zone. However, there is still a considerable amount of secure habitat below 8,200 feet.

Figure 6. Bear analysis units outside the Greater Yellowstone Ecosystem Grizzly Bear Recovery Zone

In addition to secure habitat related to motorized human access, the other major human activities that affect grizzly bears and/or their habitat include permanent developments (aside from roads/trails), and domestic livestock grazing. These types of land uses have historically been associated with human-bear conflicts that resulted in grizzly bear mortalities, primarily due to the presence of attractants such as human food, pet food, livestock feed, garbage, animals and/or carcasses, that draw bears into areas and/or situations where they are removed either through management actions or defense of life or property. As a result, the number of permanent human developments and livestock allotments within the Greater Yellowstone Ecosystem recovery zone has been restricted on Federal lands so as not to exceed the numbers that were present in 1998. On the Custer Gallatin National Forest, the number of developed sites and domestic livestock allotments are currently slightly below 1998 levels. There have been very few human-caused grizzly bear mortalities associated with permanent developments in the plan area in recent years, and no human-caused grizzly bear deaths associated with livestock grazing within the plan area for at least 10 years (Landenburger *in:* van Manen et al. 2015). Additional information on numbers, distribution, and status of livestock allotments relative to grizzly bear habitat can be found in the Range specialist report.

In addition to managing the number of developed sites and livestock allotments, a "food storage order" is in effect that covers all Federal land where grizzly bears occur in the Greater Yellowstone Ecosystem. This order requires that Federal land users, whether recreational or administrative, must keep food and other possible attractants stored in a manner that minimizes potential for bear-human conflict. For example, human food and garbage must be acceptably stored (in bear-resistant containers or out of reach of bears) unless it is currently being prepared or consumed, or is otherwise attended. Big game carcasses left by hunters must also be acceptably stored, which means either a minimum distance away from human use areas such as trails and camp sites, or hung out of reach of bears. Likewise, livestock carcasses must be managed so as not to attract bears into human use areas. Human-caused grizzly bear mortalities still occur in the Greater Yellowstone Ecosystem, but largely due to such management restrictions, human-caused mortalities are not causing grizzly bear population declines (USDI Fish and Wildlife Service 2016). The portion of the Greater Yellowstone Ecosystem in Montana (of which the Custer Gallatin National Forest plan area is a major part) averages about four and a half human-caused grizzly bear deaths annually (Frey, K., 2014, personal communication). Interagency Grizzly Bear Study Team Annual Reports indicate that over the past 7 years (2009 to 2015) there has been an average of two human-caused grizzly bear mortalities within the Custer Gallatin National Forest plan area.

Habitat connectivity is quite good in the Greater Yellowstone Ecosystem, due to relatively high levels of secure habitat both within and outside the recovery zone, particularly on public lands. Conservation measures are in place to ensure continued management practices that have facilitated habitat connectivity in the Greater Yellowstone Ecosystem. However, there are large expanses of mostly private land, with substantial barriers such as Interstate highways, high road densities, cities, towns and agricultural areas that separate the Greater Yellowstone Ecosystem from other grizzly bear ecosystems to the north. Consequently, the Greater Yellowstone Ecosystem grizzly bear population has been geographically and genetically isolated from other grizzly bear populations for perhaps over a century (USDI Fish and Wildlife Service 2016). Nevertheless, Kamath and others (2015) reported a low rate (0.2 percent) of inbreeding in the Greater Yellowstone Ecosystem grizzly bear population since 1985, and indicated no notable decline in genetic diversity within the population in recent decades.

The Greater Yellowstone Ecosystem is the southernmost, and one of the largest, grizzly bear populations remaining in the conterminous United States. The other large grizzly bear population in the lower 48, and also one of the closest to the Greater Yellowstone Ecosystem, is in the Northern Continental Divide Ecosystem, which is located in northwestern Montana, roughly 100 miles straight line distance from the Greater Yellowstone Ecosystem. The Northern Continental Divide Ecosystem population is not only important because of its size and proximity, but also because it is contiguous with grizzly bear populations and habitat in Canada, which enhances the genetic diversity of the Northern Continental Divide Ecosystem population. In over 50 years of monitoring, there has been no evidence of genetic exchange between the Greater Yellowstone Ecosystem and Northern Continental Divide Ecosystem grizzly bear populations, suggesting that the distance and intervening human developments pose significant barriers to grizzly bear movement (Haroldson et al. 2010).

Since the Custer Gallatin National Forest plan area covers much of the northern portion of the Greater Yellowstone Ecosystem for grizzly bears, it is important in terms of facilitating connectivity with the Northern Continental Divide Ecosystem to the north. Walker and Craighead (1997) conducted pioneering work to identify potential movement corridors for grizzly bears, using least-cost-path modeling technology. They identified three possible corridors between the Greater Yellowstone Ecosystem and Northern Continental Divide Ecosystem through: (1) the Big Belt, Bridger and Gallatin Mountains; (2) the Boulder, Tobacco Root, Gravelly and Taylor-Hilgard Ranges; and (3) the Selway, Bitterrott, Lemhi, Centennial and Madison Mountain ranges. Each of these routes involves some portion of the Custer Gallatin National Forest plan area.

A decade later, Cushman and others (2008) presented additional science relative to linking these two ecosystems for grizzly bears, and again, identified the Bridger and Big Belt Mountain Ranges as the most important corridor for connectivity. The Bridger Mountain Range is within the Custer Gallatin National Forest plan area. It is a relatively small, isolated mountain range with a north-south alignment, located north of Bozeman, Montana. The Bridger Range contains proportionately more private inholdings, human development and use than the Madison, Gallatin, and Absaroka-Beartooth Ranges where grizzly bears currently roam. Grizzly bears would have to cross Interstate 90, a frontage road, and railroad tracks, plus intermingled private development to get from currently occupied habitat in the plan area to the Bridger Range and vice versa. At least one underpass has been constructed to facilitate wildlife crossing of Interstate 90. To date, black bears have been documented to use this crossing structure, but there is no known grizzly bear use; however, similar underpasses have been used by grizzly bears in Alberta Canada (Sawaya et al. 2013).

Madison, Gallatin and Absaroka and Beartooth Mountains

This is currently the only landscape within the plan area that is occupied by grizzly bears, and for which suitable habitat has been identified for the Greater Yellowstone Ecosystem population of grizzly bears. This landscape covers roughly 1,600 square miles inside the recovery zone, of which approximately 1,500 square miles (94 percent) is National Forest System land. The remainder of this landscape is outside of the recovery zone, and covers about 2,062 square miles, of which, roughly 1,872 square miles (91 percent) is National Forest System land. The Madison, Gallatin, and Absaroka and Beartooth Mountains landscape is almost completely within the most current (2014) distribution area for grizzly bears (see Figure 4 above). A notable outlier is at the north end of the Gallatin Mountain Range, in an area that includes Hyalite and Bozeman Creek drainages. Due to its proximity to Bozeman and easy access, this area receives a very high level of human use; in fact, some of the highest use in the Northern Region of the Forest Service, which may well explain the lack of use by grizzly bears. Another notable area outside the current grizzly bear distribution is in the Beartooth Mountains in the northeastern part of this landscape. While grizzly bears have been documented from time to time in this area, it remains largely unoccupied, perhaps limited by the lack of forested cover, and/or high human presence (Bjornlie et al. 2014).

The Madison, Gallatin, and Absaroka and Beartooth Mountains landscape is largely intact, with high habitat diversity, and corresponding high quality habitat for grizzly bears. A large portion of this landscape is protected by federally designated areas such as wilderness, wilderness study areas, and inventoried roadless areas that contain restrictions on human uses. Inside the recovery zone, about 810 square miles, or roughly 51 percent of the Custer Gallatin National Forest plan area inside the recovery zone, is designated wilderness, which has the highest level of restrictions on human use. An additional 430 square miles, or about 27 percent of the plan area inside the recovery zone, is in inventoried roadless or wilderness study areas, which have some level of restriction on human uses. Outside the recovery zone, 833 square miles, or roughly 40 percent of the plan area outside the recovery zone, is designated wilderness. Another 615 square miles, or about 30 percent of the plan area outside the recovery zone, is inventoried roadless or wilderness study area. In summary, roughly 78 percent of the plan area inside the recovery zone has some degree of permanent land use restrictions, while about 70 percent of the plan area outside the recovery zone has similar restrictions. In part due to these land allocations, this landscape has a high degree of habitat connectivity for grizzly bears and other wildlife. However, it is crossed by Montana State Highways 287, 191 and 89, and also includes major human developments such as the communities of West Yellowstone, Big Sky, Gardiner and Cooke City/Silvergate. These feature likely impact the ability of bears to move through suitable habitat, but are not considered barriers to movement because bears have been known to successfully traverse across and/or through them (Haroldson, M., 2016, personal communication).

Secure habitat, or the area located away from motorized routes, is very important to grizzly bears. The amount of secure habitat within the plan area is reflective of the amount of protected (designated wilderness, inventoried roadless and wilderness study areas) areas. The entire Madison, Gallatin, and Absaroka and Beartooth Mountains landscape is about 77 percent secure habitat. As noted above, roughly 44 percent of the suitable habitat in the Custer Gallatin National Forest plan area is inside the recovery zone. Secure habitat is similarly distributed, with about 45 percent of the total secure habitat located inside the recovery zone. About 63 percent of secure habitat inside the recovery zone is located at or above 8,200 feet elevation; whereas roughly 55 percent of secure habitat outside the recovery zone is at higher elevations where human use is less concentrated. Correspondingly, non-secure habitat in the plan area occurs more frequently at lower elevations (below 8,200 feet) both within and outside of the recovery zone.

Bridger, Bangtail, and Crazy Mountains

This landscape area is outside of the distinct population segment area for the Greater Yellowstone Ecosystem grizzly bear population and no grizzly bears have been documented in this landscape for decades (USDI Fish and Wildlife Service 2016). However, these small, isolated mountain ranges located north of the Greater Yellowstone Ecosystem Distinct Population Segment area, are potentially important travel corridors that could eventually facilitate grizzly bear dispersal between the Greater Yellowstone Ecosystem and Northern Continental Divide Ecosystem populations (Walker and Craighead 1997; Cushman et al. 2008; van Manen, 2016, personal communication).

Pryor Mountains

This landscape is within the distinct population segment area for the Greater Yellowstone Ecosystem grizzly bear population, but is not identified as suitable habitat. There have been no documented occurrences of grizzly bears in this landscape. There are historic records of grizzly bears in eastern Wyoming, southeast of the Pryor Mountains, but the best available information indicates that grizzly bears were not as common in these prairie habitats as they were in the more mountainous habitats to the west (USDI Fish and Wildlife Service 2016). The Pryor Mountains do not have high potential to contribute to connectivity within the Greater Yellowstone Ecosystem grizzly bear population, or between the Greater Yellowstone Ecosystem and other grizzly bear ecosystems in the contiguous United States (van Manen, personal communication 2016).

Ashland District

This landscape is outside of the Greater Yellowstone Ecosystem Distinct Population Segment area and grizzly bears do not occur there.

Sioux District

This landscape is outside of the Greater Yellowstone Ecosystem Distinct Population Segment area and grizzly bears do not occur there.

Key Benefits to People

Grizzly bears have limited distribution in the continental United States, and just the possibility of seeing one in the wild is a tremendous draw for many tourists visiting the plan area. Grizzly bears are a symbol of wildness and great power for many people, and whether they ever see one or not, the mere knowledge that grizzly bears exist is vitally important to these folks. The biological recovery of grizzly bears in the Greater Yellowstone Ecosystem is for many, an example of success for the Endangered Species Act. At the same time, restrictions on land uses designed to protect grizzly bears and their habitat are often viewed as too stringent, and an unnecessary infringement on the rights of people to use public land. Grizzly bears can have direct economic impacts on livestock producers through depredations, and can damage property in search of food. Finally, grizzly bears are large predators, easily capable of injuring or killing humans, and therefore, feared by some.

Trends and Drivers

Interactions with humans are by far the leading factors affecting the Greater Yellowstone Ecosystem grizzly bear population (USDI Fish and Wildlife Service 2016; Schwartz et al. 2010), including within the plan area. Therefore, the temporal scale used to consider trends for this assessment is the period after European settlement in the Greater Yellowstone Ecosystem, from about the late 1800s to present.

Prior to European settlement in North America in the late 1800s, grizzly bears roamed throughout most of Alaska, western Canada, the western half of the continental United States and central Mexico. Population numbers for grizzly bears pre-European settlement were estimated at about 50,000 animals (USDI Fish and Wildlife Service 2016). Grizzly bear numbers and distribution declined precipitously coincident with European settlement. Permanent conversion of grizzly bear habitat occurred through construction of homesteads and development of towns and cities. Habitat was also altered by agriculture, livestock grazing, timber harvest and mineral development. Important bear food sources were greatly reduced or even depleted by subsistence and commercial hunting and fishing, habitat conversion, and competition from domestic livestock. Further, grizzly bears were persecuted through hunting, trapping, and poisoning to reduce depredation on domestic livestock (Guenther et al. 2014). By the 1930s grizzly bear populations and distribution were reduced to less than 2 percent of their estimated range and numbers prior to European settlement (USDI Fish and Wildlife Service 2016).

Historically, open pit garbage dumps in and around Yellowstone National Park were an important food source for Greater Yellowstone Ecosystem grizzlies. Out of concern for public safety as well as to remove an unnatural food source for bears, land management agencies closed the open pit dumps in the 1970s. Abrupt elimination of this important food source resulted in high mortality rates for bears, primarily through management removal of bears that created conflicts in search of alternate food sources. In 1975, after sharp increases in grizzly bear mortality associated with closure of the garbage dumps, the grizzly bear was listed as a threatened species under the Endangered Species Act (Guenther et al. 2014).

After being listed as a threatened species in 1975, the Greater Yellowstone Ecosystem grizzly bear population began to rebound in the 1980s, likely at least in part due to implementation of management measures to reduce human-caused bear mortalities. Such measures coincided with the establishment of the Interagency Grizzly Bear Committee in 1983. The population experienced robust growth after that point, particularly in the 1990s, and had achieved all demographic recovery criteria by 1998. The Interagency Grizzly Bear Study Team estimated population growth levels from 4 to 7 percent between 1983 and 2001, with a leveling off, but stable to slightly increasing trend from 2002 to present. The Interagency Grizzly Bear Study Team estimates the Greater Yellowstone Ecosystem grizzly bear population size and assesses trends by counting annual sightings of individual female grizzlies with cubs of the year. In 2015, they estimated the Greater Yellowstone Ecosystem grizzly bear population to be 757 animals (van Manen et al. 2015).

Doak and Cutler (2014) questioned the methods used by the Interagency Grizzly Bear Study Team to estimate grizzly bear population numbers and trends. They suggested that population increases reported in recent decades were likely due to increased survey efforts and improved ability to sight bears, rather than the result of actual increases in bear numbers. They also challenged Interagency Grizzly Bear Study Team methods of accounting for reproductive senescence (decreased reproductive fitness after a certain age), and ultimately concluded that the Greater Yellowstone Ecosystem grizzly bear population has increased far less than reported by the agencies. Van Manen and others on the Interagency Grizzly Bear Study Team (2014) responded to these critiques by demonstrating that the perceived increase in survey effort was attributed to a notable increase in grizzly bear distribution; i.e., a much larger area to survey required additional effort. They also noted that there is no empirical evidence to show that the probability of seeing grizzly bears has increased over time. Finally, van Manen and associates (Interagency Grizzly Bear Study Team 2014) said their findings show minimal contribution of age-specific survival on population trends, and argued that Doak and Cutler (2014) chose extreme measures for reproductive senescence, which led to inaccurate conclusions that were not supported by empirical evidence. The Interagency Grizzly Bear Study Team grizzly bear population estimates and associated demographic analyses are conducted by a team of about a dozen scientists, using methods that are critically reviewed and evaluated. Therefore, we feel the population estimates provided by the Interagency Grizzly Bear Study Team are based on sound scientific principles, and present the best available scientific information for this assessment.

As the Greater Yellowstone Ecosystem grizzly bear population has been increasing in numbers over time, the area occupied, or distribution of the species, has also increased. When the grizzly bear was listed as a threatened species in the 1970s, its distribution was generally limited to the area inside the recovery zone. During the 1980s their distribution started to creep outside the recovery zone boundary, and in the 1990s expanded outside the recovery zone and continued to grow. The grizzly bear distribution area showed a 38 percent increase from 2004 to 2010 alone, and has continued to grow, although perhaps not as rapidly since 2010 (Bjornlie et al. 2014). Expansion has occurred within the plan area as well, increasing distribution to the north and west in the Madison Range, to the north in the Gallatin Range, and to the north and east in the Absaroka and Beartooth Ranges. Figure 3 and Figure 4 show the increase in grizzly bear distribution within the plan area since the early 1970s. The Greater Yellowstone Ecosystem grizzly bear population cannot continue to grow unrestrained forever, because resources available to support such growth are finite (USDI Fish and Wildlife Service 2016). Recent studies suggest that the Greater Yellowstone Ecosystem grizzly population growth rate is beginning to slow as bear densities increase and the population is nearing carrying capacity (Interagency Grizzly Bear Study Team 2013).

Human persecution of grizzlies in the late 1800s and early 1900s dramatically reduced bear numbers and distribution, until they were relegated to a few small isolated populations in the continental United States. The Greater Yellowstone Ecosystem contains the southernmost of the two largest remaining grizzly bear populations in the lower 48 states. The northern counterpart is the Northern Continental Divide Ecosystem located in northwest Montana. Just as the Greater Yellowstone Ecosystem population has been expanding, so too has the grizzly bear population in the Northern Continental Divide Ecosystem. Currently, they are estimated to be approximately 165 kilometers (103 miles) straight line distance apart. Male grizzly bears are capable of long distance dispersal, and on average disperse about three times further than females. Grizzly bear dispersals of 175 kilometers (109 miles) have been recorded, so a natural connection of the Greater Yellowstone Ecosystem and Northern Continental Divide Ecosystem populations is possible. However, there are significant human-created barriers to grizzly bear movement between these populations (Haroldson et al. 2010). Cushman and others (2008) identified potential barriers as gaps between federally-owned landscapes, as well as areas within and between Federal ownership where major highways are present. They noted that grizzly bears attempting to move between the Greater Yellowstone Ecosystem and Northern Continental Divide Ecosystem would encounter a minimum of six potential barriers on the two most likely corridors (least-cost paths) between the ecosystems. Human use and associated land development is increasing rapidly in the Greater Yellowstone Ecosystem and this rate of increase is expected to continue. See Social/Economic specialist reports for more details on human population growth.

In addition to habitat condition and connectivity, human uses and land management activities are often drivers of grizzly bear daily and seasonal use patterns, distribution, and mortality risk levels. Vegetation management can change the amount of forest cover on the landscape, influencing food and security availability for grizzly bears and their prey species. Vegetation management within the Custer Gallatin National Forest plan area has changed over time from an emphasis on timber production and clear-cutting in the mid- to late-20th century, to fuels reduction projects using thinning and prescribed burning in the 21st century. This management shift has focused vegetation management activities in the wildland-urban interface; a shift that has likely been beneficial to bears by concentrating vegetation management closer to areas that are already roaded and developed for human use, thereby reducing the need for new road construction, and typically leaving more trees on the landscape to provide cover for bears and prey species. Livestock production has also been a driver of grizzly bear populations over time, as lethal control was a primary method for dealing with grizzly bear depredation on domestic livestock during the early European settlement of the western United States (Gunther et al. 2014). After grizzly bear numbers dropped precipitously and the species became protected under the Endangered Species Act, livestock management on Federal lands changed so that conflicts were often managed in favor of bears, at least within the grizzly bear recovery zone. For the portion of the plan area within the grizzly bear recovery zone, the number of livestock grazing allotments has decreased slightly since 1998, and all domestic sheep allotments have been closed.

Human recreation also drives grizzly bear use patterns and mortality risk. High human use areas, particularly those with high open motorized route densities, may be avoided and subsequently underused by grizzly bears. Travel management plans have been developed for the plan area in recent years (2006 on the Gallatin side, and 2008 for the Beartooth Ranger District). These plans dictate what types of travel may be used for public and administrative purposes, and have generally resulted in lower motorized route densities and corresponding increases in secure habitat in grizzly bear use areas. Human-caused grizzly bear mortalities are often the result of self-defense when big game hunters are threatened by grizzly bears, or less frequently, in the case of mistaken identity by black bear hunters. Hunter education programs and bear safety awareness programs have improved public knowledge and contributed to a reduction in bear-human conflicts and associated human-caused bear mortalities. Food storage orders were employed within the grizzly bear recovery zone in the early to mid-1980s, and expanded to cover all of the plan area within suitable grizzly bear habitat in recent years. We believe that this effort has also contributed to an overall decline in human-bear conflicts over time.

Grizzly bears spend most of the winter in dens as a strategy to reserve energy in times of low food availability. Cubs are born during the winter denning period, placing additional energetic demands on reproductive females. Winter use has the potential to disturb denning bears, and can result in negative impacts ranging from decreased energy reserves due to movement within the den, to den abandonment (Podruzny et al. 2002). Podruzny and associates (2002) used known grizzly bear den sites to define potential denning habitat in the Greater Yellowstone Ecosystem, and concluded that suitable denning habitat is abundant. These authors evaluated human access to potential grizzly bear denning areas based on area use restrictions, terrain limitations, and available technology. They found that only 26 percent of the potential grizzly bear denning habitat on the Gallatin part of the plan area was vulnerable to disturbance from snowmobile use. The majority of potential denning habitat on the Custer side of the plan area is within designated wilderness. Winter access technology has improved somewhat since that study was conducted, but a large portion of the suitable habitat within plan area (73 percent) is within designated wilderness, wilderness study area, or inventoried roadless, so it is reasonable to assume that the proportion of potential denning habitat vulnerable to disturbance from snowmobile use is still relatively low. Back-country skiing could also impact grizzly bears at den sites, but denning habitat is typically remote, and difficult to access by foot.

As noted previously, grizzly bears have the evolutionary strategy of an opportunistic omnivore, which allows them to make use of a wide variety of food sources, making them habitat generalists with a demonstrated ability to adapt to changing environmental conditions (Gunther et al. 2014). However, there have been recent habitat trends that have raised concern for the future of the Greater Yellowstone Ecosystem grizzly bear population. Most notable among these are recent declines in whitebark pine seed production largely due to mortality from mountain pine beetles (Interagency Grizzly Bear Study Team 2013; Schwartz et al. 2014; Gunther et al. 2014; Ebinger et al. 2016; USDI Fish and Wildlife Service 2016). When abundant, whitebark pine seeds are an important food source for grizzly bears in that they easily digested, high in protein and fat content, and located it higher elevations that generally have greater proportions of secure habitat. Notable reductions in cone-bearing whitebark pine trees began to occur around the turn of the 21st century. Many authors have reported an increase in grizzly bear/human conflicts in years of poor whitebark seed production, and consequently, considerable research has been conducted in recent years to determine the extent of Greater Yellowstone Ecosystem grizzly bear's reliance on this important food source (USDI Fish and Wildlife Service 2016). Notably, whitebark pine occurs on only about 14 percent of the occupied grizzly bear range in the Greater Yellowstone Ecosystem (Gunther et al. 2014). It is a cyclic species, producing cones every two to three years; therefore it is not available to all bears in all years, even under the best of conditions.

Costello and others (2014) examined changes in grizzly bear habitat use patterns from 2000 to 2011, which corresponds to the recent period of high mountain pine beetle mortality in whitebark pine. They found that regardless of mountain pine beetle activity, about a third of the grizzly bears in their study had home ranges with little or no whitebark habitat in them. For those bears that did show habitat selection for whitebark pine, these authors found no notable changes in home range size or movement patterns as whitebark pine declined, in other words, bears did not roam further in search of food, but rather were able to find alternate food sources within their established home ranges. Ebinger and associates (2016) looked at grizzly bear use of ungulates in the Greater Yellowstone Ecosystem and found that as whitebark pine was declining due to mountain pine beetle impacts, bear use of large ungulate carcasses increased in the fall when whitebark seeds are typically available. Further, studies of Greater Yellowstone Ecosystem grizzly bear body condition showed no significant differences between good and poor whitebark pine seed production years, and that overall body condition of bears did not decline during the recent period of whitebark pine mortality. Based on multiple factors, a conclusion was reached that the recent decline in whitebark pine had no notable negative impact on grizzly bears in the Greater Yellowstone Ecosystem, for individuals or at the population level (Interagency Grizzly Bear Study Team 2013).

Besides whitebark pine, ungulate biomass is the other key food source available to grizzly bears in the plan area. Big game species abundance and distribution has also changed over time within the plan area and surrounding landscape, due to a variety of factors including changes in human use patterns, as well as changes in predator-prey dynamics (Ebinger et al. 2016). Detailed analyses for individual ungulate species such as elk, bison, moose, and deer are included in other sections of this assessment. The Interagency Grizzly Bear Study Team produced a thorough compilation of current best science regarding grizzly bears' response to recent changes in Greater Yellowstone Ecosystem food resources, some of which have been summarized and reported in this assessment. Readers are encouraged to consult the original Interagency Grizzly Bear Study Team (2013) publication for more detailed information.

In the future, climate change is predicted to have notable changes on grizzly bear habitat in the Greater Yellowstone Ecosystem and elsewhere. For example, projected changes in climate are expected to have continued impacts on whitebark pine abundance and distribution. Increased temperatures associated with climate change could increase the lower elevational limits of the species, potentially above the highest elevations available in some places. Climate models have predicted dramatic declines in whitebark pine distribution over the next half century, although due to a relatively high elevation baseline, range reductions may be less in the Greater Yellowstone Ecosystem than other ecosystems at lower elevations (Interagency Grizzly Bear Study Team 2013). Costello and associates (2014) noted that habitat generalists typically fare better in response to changing conditions than do habitat specialists. From this they inferred that while climate change is anticipated to result in range contraction for whitebark pine, which is a habitat specialist, the cascading effect on grizzly bears, which are habitat generalists, may not be as severe.

Climate change has the potential to affect vegetation, hydrology, fire regimes and insect populations, which in turn could influence the quantity, distribution, and elevational presence of important plant and animal food sources for grizzly bears in the Greater Yellowstone Ecosystem. Such changes may reduce or even eliminate the availability of some food sources, while other sources may increase, or be unaffected. Climate change could theoretically allow species not native to this area to move in and occupy habitat in the Greater Yellowstone Ecosystem, some of which may present new food sources to grizzly bears, while others may not. Changing climate could also influence the ability of exotic species to compete with natives, which could notably change habitat and species composition, again with possible benefits or negative impacts to grizzly bears (Gunther et al. 2014). Scientists gathered in 2009 to discuss climate change impacts on carnivores, including grizzly bears, in the northern U.S. Rocky Mountains. Among other things, they noted a potential concern over warming temperatures impacting the winter denning habits of grizzly bears, and associated potential for increased grizzly bear/human conflicts if bears spend less time in dens (Cross and Servheen 2009). However, most grizzly bear biologists attending this workshop did not expect predicted habitat alterations due to climate changes to directly threaten grizzly bears (USDI Fish and Wildlife Service 2016). The grizzly bears' dietary plasticity and proven adaptability should be advantageous in light of predicted climate change. Ultimately, human responses to climate change will likely be the most important driver to influence grizzly bear habitat and population trends (USDI Fish and Wildlife Service 2016; van Manen, 2016, personal communication).

Information Needs

As noted previously, the Greater Yellowstone Ecosystem grizzly bear population is one of the most studied populations of large carnivores in the world. Consequently, there is a wealth of scientific information available about habitat needs and potential threats to this species, with few significant gaps in the available science. However, much of the scientific information developed for grizzly bears is based on models, and there is rarely ever perfect information available to feed into models. For example, there is no census available for grizzly bears; i.e., no-one knows exactly how many bears there are, or their precise ages, home range sizes, food habits, etc. Also, data accuracy and availability changes over time can affect knowledge systems. Recent improvements in the accuracy of Custer Gallatin administrative boundaries, coupled with formal combining of the two forests, has created data inconsistencies between GIS coverages used by the Forest Service and those used by other agencies. For example, grizzly bear secure habitat (as calculated by the standard definition) is produced by running the Greater Yellowstone Ecosystem Access Model, a process conducted annually by the Interagency Grizzly Bear Study Team based on information provided by the Custer Gallatin. The corporate data set for the access model has been created over a period of many years, and although updated frequently, still does not necessarily have the most current information. The most current results of access model runs for the Greater Yellowstone Ecosystem (for the year 2014 at the time this assessment was produced), still show the Custer and Gallatin as two separate administrative units (which they were as of 2014), and do not have the most current, updated boundary locations, so there are slight differences in analysis area boundaries that are based on Forest Service administrative boundaries. Generally speaking, modeling efforts rarely produce identical results from one run to the next, often due to rounding errors or very slight, unintended alterations through data input errors, or even just due to unexplained artifacts of the model itself.

Key Findings

- Grizzly bears are currently listed under the Endangered Species Act as a threatened species in the continental United States.
- The Greater Yellowstone Ecosystem is one of the few places where grizzly bears persist in the wild in the continental United States. Grizzly bears in the plan area are part of the Greater Yellowstone Ecosystem Distinct Population Segment of the species.
- The Greater Yellowstone Ecosystem Distinct Population Segment of grizzly bears continues to meet or exceed recovery criteria, and was proposed for de-listing (removal from the Endangered Species list) by the U.S. Fish and Wildlife Service in March 2016. Until a final rule to de-list the Greater Yellowstone Ecosystem grizzly bear is published, the species will remain listed as a threatened species.
- Suitable habitat for grizzly bears in the plan area is located in the Madison/Gallatin/Absaroka/Beartooth landscape. Nearly 20 percent of the suitable habitat identified for Greater Yellowstone Ecosystem grizzly bears is within the Custer Gallatin National Forest administrative boundary. Roughly 17 percent of the Greater Yellowstone Ecosystem grizzly bear recovery zone (or primary conservation area) is within the Custer Gallatin National Forest boundary.
- The grizzly bear population has been increasing in number and expanding in distribution within the plan area since the 1980s. Most of the suitable habitat identified within the plan area is currently used by grizzly bears (i.e., within the known distribution of the species).

- Secure habitat for grizzly bears has increased in the plan area over time, and is currently about 77 percent overall, with 79 percent secure inside the recovery zone and 75 percent secure outside the recovery zone.
- The Custer Gallatin National Forest plan area covers much of the northern portion of the Greater Yellowstone Ecosystem for grizzly bears, and is therefore important in terms of facilitating connectivity between the Greater Yellowstone Ecosystem and the Northern Continental Divide Ecosystem to the north.
- Grizzly bears are habitat generalists and therefore not expected to be negatively affected by habitat alterations due to climate change. Rather, human responses to climate change will likely be the most important driver to influence grizzly bear habitat and population trends.

Canada Lynx (*Lynx canadensis*): Threatened

Introduction

The Canada lynx is a medium-sized forest carnivore that is strongly associated with one primary prey species, the snowshoe hare (*Lepus americanus*). Both the lynx and its primary prey are highly adapted to survive in boreal climates, where winters are characterized by deep accumulations of soft, fluffy snow (Koehler and Aubry 1994). The lynx' long legs and large, furry feet that make it well adapted to travel across deep snow in pursuit of hares, give this species a competitive advantage for hunting in wintery conditions over other more generalist predators such as bobcats (*Lynx rufus*), mountain lions (*Felis concolor*), and coyotes *(Canis latrans*) (Bell et al. 2016). Lynx and snowshoe hares are dependent on forested environments, where a diversity of structural stages may be used to meet various life cycle needs. The Canada lynx was listed as a threatened species under the Endangered Species Act in March 2000. In this listing, the U.S. Fish and Wildlife Service indicated that lynx in the contiguous United States present a distinct population segment, and that the single factor threatening the distinct population segment was the inadequacy of existing regulatory mechanisms, including the lack of guidance for conservation of lynx in national forest land and resource management plans (USDI Fish and Wildlife Service 2000). In 2009, the U.S. Fish and Wildlife Service designated critical habitat for lynx, and revised the critical habitat designation in 2014. Lynx were historically present in the plan area, and are still found in the western part of the plan area, although recent detections have been rare. Much of the western portion of the plan area is within designated critical habitat for lynx.

Process and Methods

Scientific literature plus agency reports and records were researched for the best available scientific information with which to inform this assessment. In addition, a geographic information system (GIS) was employed to estimate amounts of lynx habitat within the plan area, using the Northern Region VMap database, which represents vegetative conditions based on remotely-sensed (satellite-imagery) reflections of the Earth's surface. Forest Inventory Analysis data, which are ground-based vegetation data collected systematically across the nation, were used to further refine estimates of potential lynx habitat. Lynx habitat was modeled by selecting potential vegetation types that are assumed capable of producing the boreal-subalpine forest types preferred by lynx and their primary prey species, snowshoe hare. Potential vegetation type is a very coarse filter system for estimating potential vegetation, or in other words, provides a broad-scale prediction of indicated climax species. Forest vegetation can go through a series of different stages before it reaches its potential, or climax state. Multiple successional stages may be used by lynx and snowshoe hares for different purposes. Therefore, the lynx habitat assessment was further refined through an evaluation of existing forest cover types by considering dominant tree species, average tree size, tree density, and number of canopy layers. This method produced a coarse estimate of potential lynx habitat across the plan area.

More refined models have been developed for predicting lynx habitat conditions at a finer scale by incorporating known site-specific conditions and disturbance events. Most recently, model development has occurred through a collaborative effort by the east-side forests of the Northern Region (Helena, Lewis & Clark, and Custer Gallatin). This effort was designed to produce a uniform method to identify and map potential lynx habitat east of the Continental Divide, in part to recognize that lynx habitat is different on the east side than it is west of the Continental Divide, where lynx habitat is more continuous and of higher quality, and subsequently where most of the lynx research in the Region has occurred. The east-side habitat modeling collaborative is a work in progress, and at the time of this assessment, was in the process of revision to incorporate new information. While the revised east-side model is expected to deliver more precision, which will provide greater utility for project-level analyses, it was not available for this assessment. The coarse filter approach used for the assessment is informative at the landscape level, and therefore appropriate for this analysis.

Scale

Canada lynx within the contiguous United States are all part of one distinct population segment. Currently, there are six geographic regions within the range of the distinct population segment that may support lynx. One of these is the Greater Yellowstone Area, which covers part of southwest Montana (including lynx habitat within the Custer Gallatin National Forest plan area) and northwest Wyoming (Bell et al. 2016). There is no specific part of the Greater Yellowstone Area delineated as an ecosystem unique to lynx, but the area known generally as the Greater Yellowstone Area encompasses about 35,000 square miles. Within the Greater Yellowstone Area, the U.S. Fish and Wildlife Service has designated critical habitat for lynx. Unit 5 (Greater Yellowstone Area) covers roughly 9,146 square miles. The Montane Ecosystem of the plan area, which covers about 2.74 million acres or about 4,282 square miles, is within the Greater Yellowstone Area and contains suitable habitat for lynx. Of this, about 2,240 square miles is designated critical habitat for lynx.

Existing Information

In the early 1990s the Forest Service initiated a concerted effort to address conservation needs of forest carnivore species, including the lynx. A result of this effort was a compilation of best available science in a General Technical Report (RM 254) entitled, "The Scientific Basis for Conserving Forest Carnivores, American Marten, Fisher, Lynx and Wolverine, in the Western United States" (Ruggiero et al. 1994). A major conclusion in that document was that "major information gaps exist for these forest carnivores." Since then, a considerable body of scientific research has been compiled regarding Canada lynx and their habitat needs. When the U.S. Fish and Wildlife Service proposed to list the Canada lynx under the Endangered Species Act in 1998, a team of scientists was commissioned by the Federal land management agencies to compile and synthesize available information on lynx. The result of this effort was a second General Technical Report (RMRS-GTR-30WWW) entitled, "Ecology and Conservation of Lynx in the United States" (Ruggiero et al. 2000). This technical information was generally referred to as "the science report" that played a major role in informing the U.S. Fish and Wildlife Service Final Rule listing the species as threatened in 2000. These two documents contain a thorough compilation of the best available scientific information available regarding the Canada lynx at that time.

At the same time, a parallel effort was underway to develop a Lynx Conservation Assessment and Strategy (Ruediger et al. 2000) which provided recommendations for conservation measures pertaining to land management activities that could place lynx at risk. A number of lynx research projects were started as a result of information gaps identified in these efforts. Since then multiple research projects have produced scientific publications, some presenting findings that filled information gaps, while others identified new questions. As a result of this new information, the Lynx Conservation Assessment and Strategy was recently updated to incorporate new information (Interagency Lynx Biology Team 2013) and another recent report was finalized by the Canada Lynx Species Status Assessment Team (Bell et al. 2016). While there is considerable science related to the species and its habitat needs, there is a notable gap in information specific to the Greater Yellowstone Area, largely because lynx habitat is more fragmented here as opposed to other areas that support lynx, and consequently there are few lynx found here to study.

Current Forest Plan Direction

As noted above in the "Introduction," the Canada lynx was listed under the Endangered Species Act for one primary reason—that being a lack of direction in land management plans to adequately conserve lynx and its habitat in response to ongoing human activities and natural processes that had the potential to threaten the species. As a result of this finding by the U.S. Fish and Wildlife Service, 18 national forests in Montana (including both the Custer and Gallatin), as well as parts of Idaho, Wyoming, and Utah, amended forest plans to incorporate guidance for conservation of lynx and lynx habitat through formal adoption of the Northern Rockies Lynx Management Direction (USDA 2007). The Northern Rockies Lynx Management Direction is the only direction in either forest plan that is specific to managing for lynx. Its focus is on minimizing impacts to high-quality snowshoe hare habitat (i.e., lynx foraging habitat) and maintaining habitat connectivity within and between lynx analysis units, which are geographic areas that contain suitable habitat for lynx and their prey species, at a scale that approximates the home range size of a female lynx (Ruediger et al. 2000).

Existing Condition

Population

As its name implies, the Canada lynx is mainly found in Canada, and its distribution is associated with North American boreal forest habitats. The contiguous United States is in the southern portion of the natural range for the species. In the contiguous United States, lynx naturally occur at low densities compared with the larger population in Canada, because the habitat in the more southern latitudes is naturally more fragmented (patchy) as it transitions from true boreal forests of the north to boreal/subalpine forests. This patchy habitat distribution limits densities of the lynx' primary prey species, the snowshoe hare, preventing hare populations in the United States from reaching the high numbers found in Canada. Because the lynx is so rare and elusive in the United States, there are no reliable population estimates for most areas of lynx occupation (USDI Fish and Wildlife Service 2000).

As far back as the late 1960s, it was reported that lynx are most common in the northwestern part of Montana, decreasing in abundance to the south and east (Koehler and Aubry *in:* Ruggiero et al. 1994). The southernmost known lynx population in Montana is in the Garnet Range, with only a few individuals present in the Greater Yellowstone Area (Interagency Lynx Biology Team 2013). However, it is currently not known if there are any lynx in either of these areas (Bell et al. 2016). Compared to northwestern Montana, there are relatively few verified historic or recent lynx occurrence records from the Greater Yellowstone Area. At the time the lynx was listed the Greater Yellowstone Area was considered to be occupied by a small, but persistent population of lynx (USDI Fish and Wildlife Service 2014). The U.S. Fish and Wildlife Service recently convened a panel of experts to gather the best available information on the current status of the Canada lynx United States Distinct Population Segment, as well as to garner professional opinion with respect to the future viability of the distinct population segment. Results from this workshop indicated that the long-term persistence capability of the Greater Yellowstone Area population is unknown. Although there is a long history of occurrence within Yellowstone National Park and surrounding areas (including parts of the plan area), size of the population and consistency of occupation is not known. Research and surveys in the Greater Yellowstone Area since 1997 have produced only a few lynx detections. Current estimates for this population are very small; likely fewer than ten individual lynx, and possibly zero (Bell et al. 2016).

There have been only a few documented occurrences of lynx presence within the Custer Gallatin National Forest plan area. The most recent was in the Absaroka Mountains in 2009. This occurrence was verified through DNA analysis of scat and hair samples, and determined to be from the same adult female lynx that was detected in the same general vicinity for six consecutive years. During this time, no other lynx evidence was detected, and it is believed this lone individual lived independently and did not encounter other lynx or reproduce within the plan area (Gehman et al. 2010). Subsequent surveys in the same vicinity and elsewhere, have not produced any verified evidence of lynx presence in the plan area. Dozens of Canada lynx were trapped from source areas in Alaska and Canada, and then relocated to Colorado between 1999 and 2006. A considerable number of these animals dispersed, including ten that traveled north into the Greater Yellowstone Area. A few of these animals, which were equipped with transmitters, were detected within the Custer Gallatin National Forest plan area (Devineau et al. 2010). Lynx movement through the plan area was transitory; i.e. none of these lynx took up residency within the Custer Gallatin National Forest. However, others apparently did occupy home ranges within the Wyoming Range of the Greater Yellowstone Area, including overlapping territories of males and females. These lynx have been detected through surveys in the Wyoming Range from 2005 to 2010 (Bell et al. 2016).

Habitat

In the contiguous United States, boreal forest transitions to subalpine forest in the western states (Ruggiero et al. 2000). In these areas, including the plan area, lynx habitat is typically found in the subalpine and upper montane forest zones. Subalpine habitat is dominated by subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*), with increasing presence of lodgepole pine (*Pinus contorta*) and pockets of aspen (*Populus tremuloides*) appearing toward the transition with upper Montane forest types. In cool, moist conditions, Douglas-fir (*Pseudotsuga menziesii*) may be a minor component of lynx habitat in the upper montane zone, often in mixed forests that also contain subalpine fir, spruce, lodgepole pine and/or aspen. The Montane habitats found at lower elevations, in warmer and drier sites, are often dominated by Douglas-fir, and less frequently by limber pine (*Pinus flexilus*), and typically do not support snowshoe hares or lynx (Interagency Lynx Biology Team 2013). Lynx habitat in the Greater Yellowstone Area is naturally fragmented by intervening open and/or drier habitats, resulting in patchy distribution, which provides only marginal conditions with limited capability to support snowshoe hares and lynx. The Greater Yellowstone Area is further from the true boreal forests of Canada than most other regions that support lynx in the contiguous United States. Given these conditions, it is likely that the Greater Yellowstone Area never has supported a large number of lynx, but rather is capable of supporting a few lynx home ranges because of the remote nature and large expanses of protected areas such as designated wilderness and national parks (USDI Fish and Wildlife Service 2014).

In a Recovery Outline for Canada Lynx, the U.S. Fish and Wildlife Service (2005) categorized lynx habitat in the continental United States as core, secondary or peripheral, based on historic and current occupation by lynx. Areas with long-term evidence of persistent populations of lynx (e.g., verified records of lynx presence over time and recent evidence of reproduction) are identified as “core” areas.

Areas with historic records of lynx presence, but no documentation of reproduction, are identified as "secondary" areas. Finally, areas with only sporadic detections of lynx, generally associated with high cycles of lynx populations in Canada, are identified as "peripheral" areas. In the Greater Yellowstone Area, core areas include Yellowstone and Grand Teton National Parks and surrounding areas, and cover about 5,209 square miles (Interagency Lynx Biology Team 2013). Within the Custer Gallatin National Forest plan area, core area basically includes the Absaroka and Beartooth Mountain Ranges. Secondary habitat within the plan area includes the Madison, Gallatin, Henrys Lake, Bridger, Bangtail, and Crazy Mountain Ranges. The Pryor Mountains are included as peripheral habitat in the plan area.

Within the plan area, the boreal, subalpine and upper montane types capable of supporting lynx and their prey species are typically found within an elevational band of approximately 6,000 to 8,800 feet. Lynx habitat is generally found where spruce or subalpine fir are the indicated climax tree species; however existing forest cover types that provide suitable lynx habitat also include lodgepole pine, aspen, and Douglas-fir, often in combination with spruce and subalpine fir. Lynx are strongly tied to their primary prey species, snowshoe hare. Therefore conditions that provide a prey base of hares also provide the best habitat for lynx. Snowshoe hares select for dense horizontal cover, that is, dense vegetation near the ground in summer, and near the snow surface in winter. Horizontal cover provides hares with food, protection from predators and thermal cover from extreme weather conditions. Dense horizontal cover is most prevalent in young, regenerating forest with high stem densities of seedlings and saplings, as well as multi-storied mature forest with smaller trees in the understory as well as live limbs of older trees at or near ground level (Interagency Lynx Biology Team 2013). Lynx will travel through more open areas when moving between patches of snowshoe hare habitat, and may occasionally find alternate prey species such as grouse and/or red squirrels (*Tamiasciurus hudsonicus*) in these areas.

Habitat that may support lynx is found only in the Montane Ecosystem of the plan area. Potential lynx habitat is estimated to occur on just over 1 million acres, or roughly 1,620 square miles, which is about 38 percent of the land base in the Montane Ecosystem. Potential lynx habitat was estimated through an evaluation of broad scale environmental conditions (e.g., slope, aspect, elevation, soil type, etc.) that are likely to produce boreal forest types where spruce and/or subalpine fir are the indicated climax species. These conditions occur across the Montane Ecosystem, in a variety of successional stages ranging from stand initiation after a recent disturbance, to regenerating forest (usually about 15 to 30 years after a disturbance event), to young-mature stands in a stem exclusion stage, to multi-storied mature and old growth forest with multiple layers in the canopy. Of these, the early (stand regeneration) and later (mature to old growth) stages have the highest potential to produce high horizontal cover, which provides the best snowshoe hare habitat, and by association, the best quality lynx habitat. The other stages; i.e., early stand initiation and stem exclusion, are still potential lynx habitat in that they may develop high horizontal cover as the stands progress toward later succession. Stem exclusion stage forest may have some utility for lynx, in that these areas typically contain adequate cover to provide relatively secure environments for lynx to travel through or rest in. However, the stem exclusion structural stage typically does not contain high horizontal cover; therefore it is not likely to be occupied by hares, and is thus not high quality foraging habitat for lynx. The early stand initiation stage that results after a disturbance generally does not contain adequate horizontal cover for hares in winter, nor does it provide enough cover to facilitate secure travel and/or resting areas for lynx. Although lynx may travel quickly through such open areas, they generally tend to avoid large openings (Squires et al. 2010).

Potential lynx habitat types were modeled using VMap, which is based on remotely sensed (satellite) imagery of vegetation on the Earth's surface. VMap is useful for estimating many aspects of potential lynx habitat. For example it classifies vegetation by lifeform, such as conifer (tree), shrub, or herbaceous (grass/forb), and can distinguish between vegetation and non-organic cover like rocks and water. It also contains information about dominant tree species, size and canopy cover which are good indicators of potential lynx habitat. However, understory structure beneath the forest canopy is important for lynx, as this component is what provides, or lacks, the horizontal cover needed by snowshoe hares. Sub-canopy layers are difficult to detect from VMap, but are recorded in ground-verified vegetation inventories (i.e., Forest Inventory Analysis). Forest Inventory Analysis data come from a continuous random sample of forest habitat conditions over time. While these data do not provide a census (100 percent coverage) at any one time, they can be reliably extrapolated to estimate conditions over a larger area. Forest Inventory Analysis data were used to estimate the proportion of boreal forest types (obtained from VMap) that have multiple canopy layers, and high tree densities (at least 1,000 trees per acre), which are the primary factors contributing to horizontal cover for snowshoe hares. Using a combination of VMap and Forest Inventory Analysis data, we estimate that approximately 60 percent of the lynx habitat within the Montane Ecosystem of the plan area provides adequate to high quality snowshoe hare habitat, which in turn provides the best lynx habitat. Most (58 percent) is in a mature, multi-story forest structure, while a minor amount (2 percent) is in the stand regeneration stage. As with any model, this provides a rough estimate of habitat conditions. It does not provide a definitive assessment of the quantity or quality of snowshoe hare habitat within the plan area. Because this method extrapolates information from plot (Forest Inventory Analysis) data to large landscapes, and is based upon a limited number of variables, it likely overestimates the amount and quality of snowshoe hare and lynx habitat in the plan area.

Female lynx select for areas with abundant coarse, woody debris for reproductive den sites. Snags and fallen logs provide cover from predators and other environmental threats to lynx kittens. Denning areas must be close to foraging habitat; i.e., high quality snowshoe hare habitat, so that the female lynx can hunt while leaving the kittens unattended nearby (Interagency Lynx Biology Team 2013). Due to recent large fires, wind events and widespread insect outbreaks across the Custer Gallatin National Forest, coarse woody debris is abundant, and therefore potential lynx denning habitat is readily available and well-distributed across the western part of the plan area. Reproductive lynx denning habitat can be found in younger, stem exclusion stage forest, as well as older (mature to old growth) forest in the Montane Ecosystem of the plan area.

In 2014, the U.S. Fish and Wildlife Service revised the designated critical habitat for lynx, including the Greater Yellowstone Area (unit 5), which covers the Custer Gallatin National Forest plan area. After the 2014 revision, the Greater Yellowstone Area unit 5 contains approximately 9,146 square miles of designated critical habitat for lynx. Areas designated as critical habitat contain the primary constituent elements, or those specific elements of physical or biological features that provide for a species' life history processes and are essential to the conservation of the species. Primary constituent elements may therefore require special management considerations or protection. The primary constituent elements specific to lynx in the contiguous United States is Boreal Forest landscapes supporting a mosaic of differing successional forest stages and containing:

- Presence of snowshoe hares and their preferred habitat conditions, which include dense understories of young trees, shrubs or overhanging boughs that protrude above the snow, and mature multistoried stands with conifer boughs touching the snow surface;
- Winter conditions that provide and maintain deep fluffy snow for extended periods of time;
- Sites for denning that have abundant coarse woody debris, such as downed trees and root wads; and

- Matrix habitat (e.g., hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe hares) that occurs between patches of boreal forest in close juxtaposition (at the scale of a lynx home range) such that lynx are likely to travel through such habitat while accessing patches of boreal forest within a home range (USDI Fish and Wildlife Service 2014).

Critical habitat is designated in those portions of the plan area with the highest potential to support residential lynx use over time (Zelenak, J., 2016, personal communication). In the Custer Gallatin National Forest plan area, designated critical habitat is located in the Gallatin, Absaroka and Beartooth Mountain Ranges, even though potential lynx habitat (i.e., boreal, subalpine and upper Montane forest types) are present in other areas such as the Madison, Henrys, Bridger, Bangtail, Crazy and Pryor Mountain Ranges. The areas outside of designated critical habitat contain conditions that may support transient use by lynx, but are not considered to provide adequate quantities and/or combinations of elements essential to meeting all life cycle needs. Within the plan area, nearly 1.5 million acres, or approximately 2,240 square miles are within unit 5, Greater Yellowstone Area designated critical habitat for lynx.

Component (a)–snowshoe hare habitat, was described above. An estimated 24 percent of designated critical habitat in the plan area falls within component (a)–snowshoe hare habitat. Component (b)–winter snow condition, is less well-defined and difficult to quantify, but because the lynx is morphologically adapted for efficient travel over deep, soft snow, winter conditions are important. The Greater Yellowstone Area is at higher elevation than most other geographic regions that support lynx. Winters can be severe in the Greater Yellowstone Area, and deep snow is rarely in short supply. However, because the Greater Yellowstone Area is naturally more open than other areas that support lynx, snow may be more exposed to sun and wind, which can form crust on the snow surface. Freeze-thaw events, or wind-loading, can change the consistency of snow, which may affect the competitive advantage for lynx. Further, snow must be in proximity to snowshoe hare habitat to be advantageous for lynx, and because snowshoe hare habitat is patchily distributed in the Greater Yellowstone Area (including the plan area), the abundance of winter snow here may be of less utility to lynx, compared with other areas that support lynx. Copeland and others (2010) modeled snow persistence in the Greater Yellowstone Area (and elsewhere) relative to habitat suitability for wolverine (*Gulo gulo*), another forest carnivore that benefits from deep snow that persists into spring. These authors showed persistent snowpack over about two-thirds of the landscape (Madison, Gallatin, and Absaroka and Beartooth Mountains) within the plan area that contains designated critical habitat for lynx. See the wolverine analysis later in this report for further details.

Component (c)–denning habitat, was described above. Due to recent disturbance processes such as fire, wind, insects and disease, tree mortality has been widespread across the plan unit in recent years, and as a result, coarse woody debris such as down trees and root wads are abundant, and well-distributed in lynx habitat for the plan area. Approximately 36 percent of the lynx habitat types are in condition likely to contain denning habitat. Component (d)–matrix habitat, is a catch-all for habitat that does not provide the cool, moist, dense vegetation and/or snowy conditions important to lynx and snowshoe hares. This includes drier forest types as well as natural and man-made openings that do not produce the dense horizontal cover required by snowshoe hares. Since matrix habitat does not contain suitable habitat for snowshoe hares, it does not provide foraging opportunities for lynx. However, matrix habitat is frequently intermingled with snowshoe hare habitat such that lynx are likely to travel through it to access better hunting grounds. As noted previously, preferred lynx habitat in the Greater Yellowstone Area (including the plan area), is naturally fragmented and therefore of lower quantity than in other areas that support lynx. Consequently, a considerable amount (estimated 60 percent) of the designated critical habitat within the plan area falls into the matrix category.

Habitat Connectivity

A common theme in this assessment is that lynx habitat in the southern extent of their range (i.e., the continental United States) is naturally more patchily distributed than in parts of Canada, which are found at more northern latitudes (Ruggiero et al. 1994; Aubry et al. 2000; Ruediger et al. 2000; Interagency Lynx Biology Team 2013; USDI Fish and Wildlife Service 2014; Bell et al. 2016.) This patchiness can result in natural habitat fragmentation where prominent areas of drier, rockier, and/or more open habitats separate patches of cooler, boreal-type forest habitats. Lynx habitat within the Greater Yellowstone Area is even more patchy, and further from lynx populations in Canada, than other lynx geographic units in the continental United States (USDI Fish and Wildlife Service 2014). Therefore, lynx habitat is naturally less connected, not only within the Greater Yellowstone Area, but also between the Greater Yellowstone Area and other lynx geographic areas. Human land uses have also disrupted habitat connectivity in the Greater Yellowstone Area. Permanent land conversions to agricultural, residential and/or commercial uses are more concentrated on private lands at lower elevations between large blocks of public land, whereas habitat alterations on public lands tend to be more temporary in nature, associated with vegetation management practices such as timber harvest and prescribed burning. Roads are often permanent fixtures on both public and private lands. Roads with high speeds and volume of traffic (highways) have the greatest impact on lynx habitat connectivity. While lynx are known to cross highways successfully, there is an increased risk of vehicle collision and resulting lynx mortality associated with these features on the landscape. Forest and backcountry roads generally have much lower speed limits and traffic volumes. Backcountry gravel forest roads have little influence on lynx habitat selection in Montana, and there have been no documented lynx mortalities caused by vehicle collisions on forest roads in Montana (Interagency Lynx Biology Team 2013). Impacts on lynx habitat connectivity are of concern in the northern part of the Greater Yellowstone Area (i.e., within and near the plan area) because of its importance in providing habitat connectivity to other geographic areas that support lynx.

Madison, Henrys, Gallatin and Absaroka Beartooth Mountains

This landscape contains the largest contiguous blocks, as well as the greatest proportion of potential lynx habitat in the plan area. Roughly 40 percent of this landscape is potential lynx habitat. Currently about 59 percent of the potential lynx habitat in this landscape is estimated to be suitable snowshoe hare and lynx habitat. The remainder has the potential to produce high quality snowshoe hare habitat over time, but is currently either recently disturbed (mainly fire), younger stem-exclusion stage, or older forest that lack the dense horizontal cover required by hares. The Absaroka and Beartooth Ranges are identified as “core” habitat, where the most recent (2009) lynx detections have been made, while the Gallatin, Madison and Henrys Mountains are “secondary” habitat, with a few sporadic records of lynx occurrence, the most recent in 1994 in the Gallatin Range. This landscape also contains the only designated critical habitat for lynx. Just over 60 percent of this landscape is designated critical habitat, located in the Gallatin, Absaroka and Beartooth Mountains.

Bridger, Bangtail, and Crazy Mountains

This landscape is identified as “secondary” habitat for lynx (USDI Fish and Wildlife Service 2014), but it does contain some of the cool, moist forest types that may provide potential lynx habitat. Only about a third of this landscape is considered potential lynx habitat, but of that, a considerable amount (over 70 percent) is predicted to have horizontal cover to support snowshoe hares, which are present in this landscape, but at very low densities relative to the Madison, Gallatin, and Absaroka and Beartooth Mountains landscape, based on winter track surveys and observations. There are no historic or recent verified detections of lynx occurrence within the Bridger or Bangtail Mountain Ranges, and consequently, this landscape is considered “unoccupied” (USDA 2007). However, lynx that were relocated to Colorado from Canada, dispersed northward, and two separate radio-collared males were detected in the vicinity of the Bridger and Bangtail Ranges in 2004 and 2005 respectively (Ivan 2012). These individuals were only located near the plan area once, and apparently kept moving. In other words, they made transitory movements and did not linger within or near the Bridger/Bangtail Ranges. There are historic records of lynx in the Crazy Mountain Range (McKelvey et al. 2000). However, recent surveys (2010–2011) failed to detect lynx in the Crazy Mountains. As with the Bridger/Bangtail part of this landscape, dispersing lynx from Colorado apparently passed by, but did not enter, or linger near, the Crazy Mountain Range (Ivan 2012). While this landscape does not appear to have adequate habitat to support residential use by lynx, it may provide important connecting habitat to facilitate north-south movement of lynx, which could play a role in connecting the plan area, and elsewhere in the Greater Yellowstone Area, to source populations in northwestern Montana and/or Canada. There is no designated critical habitat for lynx in this landscape.

Pryor Mountains

The Pryor Mountain landscape is an isolated patch of montane forest that contains a very minor amount (about 7 percent) of potential lynx habitat. While some of this habitat is indicated to have adequate horizontal cover for hares, this small amount of habitat is negligible and there are no observation data for snowshoe hares in the Montana Natural Heritage database for this landscape. There are no historic or recent verified records of lynx from the Pryors, but there are historic records of lynx from the Bighorn Mountains to the south (in Wyoming). The Pryor Range is identified as "peripheral" habitat for lynx. There is no designated critical habitat for lynx in this landscape.

Ashland District

There is no potential lynx habitat and no designated critical habitat for lynx in this landscape.

Sioux District

There is no potential lynx habitat and no designated critical habitat for lynx in this landscape.

Key Benefits to People

The Canada lynx is a rare forest carnivore that occupies a few small isolated pockets of boreal forest habitat in the continental United States, generally in areas adjacent to, or in close proximity to Canada, where source populations reside. Historically, lynx were trapped for their fur, but since their presence in the lower 48 states has always been at low densities, the contribution of this species to the fur trade industry was relatively minor. Since the lynx was listed as threatened under the Endangered Species Act in 2000, there has been no legal trapping season for lynx in the continental United States. Because the lynx is such a rare and elusive creature, people have a sense of wonderment, and appreciation for its mere existence, and tenacity required to survive in suboptimal habitat. People associate the lynx with wildness and mystery. The lynx is a topic of interest for scientific research, public documentaries, citizen science, as well as the arts, where it is a common theme in paintings, photography, and jewelry.

As with any federally protected species, there is an element of controversy surrounding lynx-related issues. Opinions are often polarized, with some believing that restrictions placed on human activities in order to conserve lynx, are far too rigid and are having unacceptable negative impacts on land uses and local economies. On the other hand, there are those who feel that existing protections for lynx are too lax, and that any and all human activities with the slightest potential to negatively affect lynx should be prohibited. As a result, many proposed Federal actions are litigated, with challenges from both sides of the public opinion scale.

Trends and Drivers

As noted previously, there is a dearth of knowledge related to lynx populations in the continental United States prior to its listing as a threatened species in 2000 (Ruggiero et al. 2000). In its final rule listing the Canada lynx, the U.S. Fish and Wildlife Service acknowledged that the lack of reliable information on lynx in the contiguous United States makes it difficult to estimate historic, as well as current, population levels and related trends for this distinct population segment. However, experts concluded that lynx populations occur at low densities in the continental United States relative to lynx populations in Canada, and that this has likely been the case historically as well, due to the naturally fragmented and lower quality of habitat for lynx and their primary prey species, the snowshoe hare, in this southernmost extension of their natural range (USDI Fish and Wildlife Service 2000). For the Greater Yellowstone Area, this conclusion is even more pointed because the Greater Yellowstone Area is further south than most other United States areas that currently support lynx, and is geographically isolated from source populations in Canada. Habitat for lynx and snowshoe hares in the Greater Yellowstone Area is even more patchily distributed, due to more extreme topography and other related ecological conditions. While there is good evidence to support the concept that there has been a small but persistent population of lynx in the Greater Yellowstone Area over time, it is unclear whether lynx occupation of the area has been consistent, or whether a few individuals come and go relative to habitat conditions. It may be that lynx travel here and survive for a time when habitat conditions are good and hare densities are favorable, but those individuals either disperse or expire when conditions are less favorable and hare populations decline. In other words, this population may be one that “winks on and off” in terms of Canada lynx metapopulations in the contiguous United States. It is estimated that the Greater Yellowstone Area currently supports less than ten individual lynx, and possibly none (Bell et al. 2016).

There are few verified historic or recent lynx occurrence records in the plan area. This is likely due to limited habitat conditions here, but may also be at least partly related to a lack of organized survey and/or research efforts. Low lynx occurrence within the plan area could also be affected by other factors such as competition from a variety of other predators.

Due to the strong association between lynx and snowshoe hares, the primary system drivers that affect lynx, are those events or processes that affect snowshoe hare habitat and/or populations. Snowshoe hares require moist, cool, coniferous (boreal) forest conditions, including the presence of dense horizontal cover at or near the ground. Natural factors that affect these conditions in the plan area include climate, topography, soil conditions, disturbance and forest succession. Lynx and snowshoe hares have adapted to these ecological conditions, although track and pellet surveys combined with incidental observations indicate that natural conditions the plan area support very low densities of snowshoe hares, and subsequently, only a handful of lynx. Competition from other predators can also affect lynx access to prey species, and can impact snowshoe hare populations. The Greater Yellowstone Area, including the Custer Gallatin National Forest plan area, hosts a complex suite of predators, including large, medium and small mammals, as well as avian species, most of which will take snowshoe hares as prey if the opportunity presents.

Effects of recreation on lynx and lynx habitat are not well understood. However, since lynx and snowshoe hares share an adaptation for deep, soft snow conditions, winter recreation effects have been studied. Specifically, researchers have explored a hypothesis that human activities resulting in snow compaction (such as skiing, snowmobiling, snow-shoeing, and plowing roads) could impact lynx by lending a competitive advantage to other carnivores, such as coyotes, bobcats and/or mountain lions, which do not travel efficiently in deep, soft snow conditions. Kolbe and others (2007, cited in Interagency Lynx Biology Team 2013) looked at coyote use of snowmobile-compacted routes in northwest Montana, and found that although coyotes did occasionally travel on snowmobile trails, they did not travel on, or near snowmobile routes more often randomly expected. Conversely, studies did show that the presence of compacted snowmobile routes influenced winter coyote distribution in Wyoming and Utah (Bunnell et al. 2006; Burghardt-Dowd 2010; cited in Interagency Lynx Biology Team 2013), where coyotes traveled closer to snowmobile trails than would be expected at random (Interagency Lynx Biology Team 2013). Since the plan area is geographically located between the landscapes where these studies occurred, the effects of snow compaction on lynx, snowshoe hares, and/or other potential hare predators within the plan area, are largely unknown.

Another human activity of note is furbearer harvest. Lynx were legally harvested (trapped) as a furbearer species in Montana until they became protected under the Endangered Species Act in 2000, at which time trapping and snaring of lynx became prohibited. However, as are most wild cats, lynx are vulnerable to trapping, and can be inadvertently caught in traps legally set for other furbearer species (Interagency Lynx Biology Team 2013). From 2000 through 2015, 16 lynx were reported incidentally caught in traps set for other species in Montana. Of those, seven died from injuries sustained in the trapping incident, one was released with injuries, and eight were released unharmed. In addition, two lynx have been reported as illegally shot by lion hunters in Montana (Zelenak, J., 2016, personal communication). However, none of these incidents occurred within the Custer Gallatin National Forest plan area. Since the lynx was listed under the Endangered Species Act, Montana Fish, Wildlife & Parks has revised trapping regulations to minimize the potential for lynx to get caught in traps set for other species. These revisions appear to be working, since only 3 of the 16 incidental trappings have occurred in recent years (since 2008) and all of those were released unharmed (Zelenak, J., 2016, personal communication).

Vegetation management certainly has the potential to affect lynx habitat through actions that remove, alter, or reduce the amount or density of horizontal cover in areas that are naturally capable of supporting snowshoe hares. However, habitat types that are most likely to support hares and therefore lynx, often contain spruce and subalpine fir, which typically are not preferred commercial timber species. Valuable timber species such as lodgepole pine and to a lesser extent Douglas-fir, may occur in suitable lynx habitat, and this component has been affected by timber harvest over time. Pre-commercial thinning, a procedure designed to improve overall tree growth, specifically targets removal of young, dense, seedling/sapling stage conifers, which are a key component of horizontal cover for snowshoe hares. The Northern Rockies Lynx Management Direction prohibits pre-commercial thinning in snowshoe hare habitat under most circumstances. Vegetation management can have beneficial effects to lynx habitat in mature forest types where understory cover is lacking. Removal of mature trees in the overstory can stimulate conifer regeneration, which may subsequently increase browse and cover availability for snowshoe hares (Interagency Lynx Biology Team 2013). Prescribed fire as a vegetation management tool can have similar effects to timber harvest. However, prescribed burning differs from harvest in that burned trees are typically left behind, and thus contribute to nutrient cycling, as well as to the availability of coarse woody debris for lynx denning habitat. Initially, fire can produce relatively unsuitable habitat for lynx, but over time, burned areas may regenerate to produce the type of young forest conditions that are used by hares. Fire suppression is another management action with potential to affect lynx habitat. Where early successional habitat is lacking, fire suppression could have negative impacts on lynx by limiting structural diversity. On the other hand, where large-scale disturbances have occurred recently, fire suppression may benefit lynx by preserving forest cover and/or multi-storied snowshoe hare habitat. Lynx habitat types in the western United States, including the plan area, typically have long natural fire return intervals and high fire intensity. It is generally agreed that fire suppression activities have had little impact on these areas (USDI Fish and Wildlife Service 2000).

Core habitat for lynx is located in the Absaroka and Beartooth Mountain Ranges, most of which is within federally protected, designated wilderness. Timber harvest is prohibited, and fire suppression has been negligible in the Absaroka-Beartooth Wilderness Area. Therefore, management activities have had a very minor impact on core lynx habitat in the plan area. Similarly, much of the designated critical habitat in the plan area is in the Absaroka-Beartooth Wilderness Area. Critical habitat is also designated in the Gallatin Range, part of which has been noticeably influenced by management actions including past timber management, particularly in the northern portion of the range. However, regenerating conifer stands that were harvested in the 1980s and 1990s now provide the majority of early seral snowshoe hare habitat in the Gallatin Range. A large portion of the Gallatin Range that is designated critical habitat for lynx is within the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area, a designation that also conveys restrictions on certain land management activities. In summary, due to the remote nature of lynx habitat in general, combined with the location of most core and critical habitat for the species within wilderness and other protected areas, vegetation management activities have likely been a minor driver of conditions for the bulk of lynx habitat within the plan area.

Because lynx and their primary prey are snow-adapted species with strong ties to boreal forest conditions, climate change is a chief concern for persistence of these species in the plan area and elsewhere in the contiguous United States (Gonzalez et al. 2007). The Lynx Conservation Assessment and Strategy identifies climate change as one of the primary anthropogenic drivers influencing lynx habitat in the continental United States. This document identified a number of studies that predict the ranges of multiple native species, including the lynx and snowshoe hare, will move northward and/or to higher elevations as temperatures increase due to global climate change. Shifting distribution of lynx and snowshoe hare may occur due to a variety of climate related factors including: reductions in the amount and/or connectivity of boreal forest habitat; changes in precipitation, particularly snow depth, condition, and persistence; changes in the frequency of natural disturbance events (e.g., fire, wind, insects); and changes in predator-prey dynamics as lynx lose their competitive advantage in snow (Interagency Lynx Biology Team 2013). Gonzalez and others (2007) reviewed Intergovernmental Panel on Climate Change models and predicted that the Greater Yellowstone Area, including the plan area, would experience a reduction in persistent snow cover, a change from boreal to temperate conifer forest types, and loss of potential lynx habitat by the year 2100. However, some experts have suggested that the Greater Yellowstone Area may have a future role as a refuge for lynx in the face of climate change, because of its relatively high elevation and associated greater potential to maintain winter snow levels (Bell et al. 2016).

Information Needs

Detailed information about historic and current snowshoe hare and lynx populations, and associated habitat relationships of these species, is lacking for the Greater Yellowstone Area in general, and the plan area specifically, but current population estimates for lynx in the Greater Yellowstone Area are quite low. This information gap is likely due in large part to the naturally low densities of hares, and corresponding rarity of lynx in the area, which makes research difficult. Even if lynx were found to study, low sample sizes would affect research results. That said, more information is needed regarding the ecology of snowshoe hares, lynx, and habitat in the Greater Yellowstone Area (including the plan area) in order to determine the area’s contribution to conservation of the United States Distinct Population Segment of Canada lynx. In addition to these Greater Yellowstone Area-specific information gaps, Bell and associates (2016) identified the need for further information regarding the natural range and variation in lynx and snowshoe hare population sizes, levels of hare density needed to support lynx survival and reproduction, the relationship of source populations in Canada to genetic fitness of the United States Distinct Population Segment, and the potential threats to lynx and snowshoe hare associated with climate change.

Potential lynx habitat classified as “secondary areas” are those with historical records of lynx presence with no record of reproduction; or areas with historical records and no recent surveys to document the presence of lynx and/or reproduction. Within the plan area, secondary lynx habitat is found in the Gallatin, Madison, Henrys, Bridger, Bangtail and Crazy Mountain Ranges. Of these, all but the Madison and Henrys Mountains have had recent surveys, with no detections of lynx. Additional survey efforts in the Madison and Henrys Ranges could provide information on availability of snowshoe hare habitat, hare presence and/or abundance, and potentially, presence of lynx. Such information would inform an assessment of the contribution of these ranges to lynx habitat conservation.

Finally, as per the Northern Rockies Lynx Management Direction, continued monitoring may be needed in the Bridger/Bangtail/Crazy Mountain landscape, which is currently identified as “secondary, unoccupied” lynx habitat, to determine whether any of these areas becomes occupied by lynx in the future. At the very least, these areas should be monitored for suitability and hare production, in order to serve as possible connective habitat for lynx.

Key Findings

- The Canada lynx is a medium-sized wild cat that is closely associated with boreal forest conditions, including cool, moist, coniferous forests and deep, soft snow in winter.
- The lynx is strongly tied to one primary prey species, the snowshoe hare, which has similar habitat requirements.
- Habitat in the continuous United States is at the southern extent of boreal forest, resulting in naturally more fragmented, lower quality habitat for lynx and snowshoe hare compared to core habitat in Canada.
- Lynx and snowshoe hare habitat is naturally fragmented and patchily distributed in the Greater Yellowstone Area, and it is therefore estimated that historic and present populations of these species have been quite low, but persistent.
- Lynx habitat is found only in the Montane Ecosystem of the Custer Gallatin National Forest plan area, where only about 38 percent of the landscape provides boreal forest conditions preferred by lynx and snowshoe hares. Consequently, there are very few documented occurrences of lynx within the Custer Gallatin National Forest plan area.
- Designated critical habitat for lynx is found only in the Gallatin, Absaroka and Beartooth Mountain Ranges of the plan area.
- Boreal forest species are associated with cold, snowy environments, and therefore may be more sensitive to habitat alterations produced by warming climate conditions. The Greater Yellowstone Area is identified as one area in the continental United States that may be less affected by climate change due to the relatively high elevation.

Northern Long-eared Bat (*Myotis septentrionalis*): Threatened

Introduction

The northern long-eared bat ranges across eastern and north-central United States, to the eastern edge of Montana. Rangewide, the northern long-eared bat is typically found in coniferous and deciduous forested habitat during summer, and hibernating in caves, mines and other structures during winter. In the eastern portion of its range, this species has experienced recent dramatic population declines due to the spread of white-nose syndrome, a disease that primarily affects bats in their winter hibernacula. As a result, the U.S. Fish and Wildlife Service listed the northern long-eared bat as a threatened species in April 2015 (USDI Fish and Wildlife Service 2015a). Critical habitat was not designated for this species, because the U.S. Fish and Wildlife Service found that identifying such areas (e.g., known hibernacula) could actually increase the likelihood of threat from disturbance, vandalism, and/or introduction of pathogens (USDI Fish and Wildlife Service 2016a).

Current Forest Plan Direction

Neither the northern long-eared bat nor specific bat management direction is mentioned in either the Custer or Gallatin Forest Plans. However, The U.S. Fish and Wildlife Service issued a 4(d) rule that became effective on 16 February 2016. Under the 4(d) rule areas not yet affected by white-nose syndrome and outside of the white-nose syndrome buffer zone are exempted from prohibition against all incidental take resulting from any otherwise lawful activity (USDI Fish and Wildlife Service 2016b). Currently all of the plan area within the northern long-eared bat's range is well outside of the white-nose syndrome buffer zone, and is therefore covered under the 4(d) rule.

Existing Condition

Broad-scale distribution maps show the range of the northern long-eared bat to encompass the entire Sioux District landscape (in South Dakota and Montana), and Powder River County, Montana, which covers most of the Ashland District landscape. The Ashland and Sioux landscapes are at the western edge of the northern long-eared bat's range. The majority of the plan area, including the Madison, Gallatin, and Absaroka and Beartooth Mountains, Bridger/Bangtail/Crazy Mountains, and Pryor Mountain landscapes, are all outside the range of the northern long-eared bat (USDI Fish and Wildlife Service 2016c).

While portions of the plan area (as described above) are within the reported range of the northern long-eared bat, there are no verified occurrences of the species within the plan area. Only one documented record of a northern long-eared bat exists for the entire state of Montana. A single male specimen was collected in Richland County (outside the plan area) in 1978 (USDI Fish and Wildlife Service 2015a). This specimen was recently verified as a northern long-eared bat through genetic testing (Maxell, B., 2016, personal communication). No additional detection of the species has occurred in Montana since 1978. The northern long-eared bat is considered fairly common in the Black Hills of South Dakota (USDI Fish and Wildlife Service 2015a), which is located roughly 50 air miles to the east of the plan area. The only record of the possible occurrence of northern long-eared bats in the South Dakota portion of the plan area (Sioux District landscape) was from a mist-netting effort conducted in 2005. Multiple bats caught in mist nets were visually identified and subsequently reported as northern long-eared bats (*Myotis septentrionalis*). However, the northern long-eared bat is similar in appearance to, and therefore may be confused with, similar species such as the little brown bat (*M. lucifugus*) and the long-eared myotis (*M. evotis*) (USDI Fish and Wildlife Service 2015a). Since there was no validation (e.g., genetic testing) beyond visual identification, the observation records for the Sioux district of the plan area are considered provisional and the identification to species is noted to be questionable (Maxell, B., 2016, personal communication; Montana Natural Heritage Program database 2016). In recent years (2015 to 2016) multiple bat survey efforts have been repeated in the plan are within the northern long-eared bat range. These efforts included methods such as mist netting, acoustical recordings, and genetic sampling of guano (feces) and wing tissue, with no verified detections of northern long-eared bats in the plan area (Maxell, B., 2016, personal communication). There are no known hibernacula or roost trees documented for northern long-eared bats in the Montana or South Dakota portion of the plan area.

Habitat Use and Distribution

There are roughly 150,000 acres of northern long-eared bat summer roosting habitat (e.g., conifers and deciduous trees) in the range of this species that overlaps the plan area. The Ashland and Sioux Ranger Districts are dominated by coniferous forest habitat. Hardwood tree species are limited to riparian areas and woody draws, which are minor habitat components. In summer, northern long-eared bats use forested areas where they can find suitable roosts in trees at least 3 inches dbh either singularly or in colonies under loose bark, in crevices, or in cavities of both live and dead trees. Roost trees used by maternity colonies typically range from 4 to 10 inches dbh. Males and non-reproductive females may also roost in cooler sites such as caves or mines if available, and the species will occasionally roost in barns or abandoned buildings if trees are not available (USDI Fish and Wildlife Service 2015a). The majority of known roosts for this species have been found in hardwood tree species in eastern North America. Where roosts have been found in coniferous forest habitats, the majority of roost sites were found in snags rather than live trees (Perry and Thill 2007). In the Black Hills this species has been documented to use ponderosa pine snags for roosting (Cryan et al. 2001). Most studies to date suggest that hardwood trees are most likely to provide the characteristics of roost sites preferred by maternity colonies and groups of female bats (USDI Fish and Wildlife Service 2015a).

Recent (2012) wildfires have produced an abundance of snags, most notably on the Ashland District. Burned snags may provide roosting habitat for bats, but generally some degree of live canopy is found near roost sites (USDI Fish and Wildlife Service 2015a). In addition to forested habitat for potential summer use areas, there are approximately 5 miles and 24 miles of rimrock cliffs in the Ashland and Sioux Ranger District landscapes, respectively. Rimrock cliffs are riddled with cracks and small holes which may also provide suitable summer roosting habitat for northern long-eared bats.

There are no known wintering areas for this species in the portion of the plan area within its range. Northern long-eared bats typically use large caves with large entrances and passages for winter hibernacula, and are often found in areas of highest humidity within the cave (USDI Fish and Wildlife Service 2015a). Caves in the Ashland and Sioux landscapes are primarily wind formed. They typically do not contain extensive passageways, and are generally dry; e.g., lack hydrologic features and maintain low humidity. Only two small caves are known for the Ashland landscape. While there are numerous small caves in portions of the Sioux landscape, there are no known large caves or active or abandoned underground mines present (see Minerals specialist report, karst and cave discussions, for more details).

Trends and Drivers

The primary threat to the northern long-eared bat is from a fungal disease called white-nose syndrome. The northern long-eared bat appears to be one of the most highly susceptible species to this disease. However, it also seems that the northern long-eared bat is less common, or even rare at the western edge of its range (USDI Fish and Wildlife Service 2015a), which covers the plan area. White-nose syndrome typically affects bats in winter hibernacula, although in some cases, bats may be exposed to the fungus year-round (USDI Fish and Wildlife Service 2015a). There are no known winter hibernacula within the plan area. No systematic cave inventories or evaluations have been completed for the

Ashland or Sioux landscapes, but the general climate and geology in these landscapes are not conducive to producing the type of cave environment typical of winter hibernacula used by the northern long-eared bat. The entire plan area is currently well outside the white-nose syndrome buffer zone. However, the U.S. Fish and Wildlife Service has indicated that the disease is likely to spread across the entire range of the northern long-eared bat in the future. Different models estimate various timeframes for the spread of this disease, but based on the known average rate of spread to date, white-nose syndrome could be present within the entire range of the northern long-eared bat within 6 to 12 years from now. Bats are also susceptible to other diseases (e.g., rabies), and while northern long-eared bats have been reported with rabies infection, this disease (unlike white-nose syndrome) has not been shown to have notable effects to northern long-eared bats at the population level (USDI Fish and Wildlife Service 2015a).

Human activities can affect bats, and although white-nose syndrome is transmitted primarily by bat-to-bat contact, there is some evidence that suggests that the fungal spores associated with white-nose syndrome can also be transmitted by humans (USDI Fish and Wildlife Service 2015a). Consequently, a national plan was developed by the U.S. Fish and Wildlife Service along with other state and federal agencies to minimize and/or slow the spread of white-nose syndrome. Possible mitigation measures may include actions such as mine and cave closures; advisory information for cavers, and/or decontamination protocols (USDI Fish and Wildlife Service 2015b). To this same end, the Montana Natural Heritage Program has developed a bat and white-nose syndrome surveillance plan and protocols (Maxell 2015). The Montana Heritage program has continued with bat surveys in the portion of the plan area within the range of the northern long-eared bat, (both Montana and South Dakota) in recent years (Maxell, B., 2016, personal communication). Humans are not only potential vectors of white-nose syndrome, but also can create noise and disturbance that may impact bats at summer roosts as well as in hibernacula. A number of carnivorous birds, mammals and even snakes are known to prey on bats occasionally. Northern long-eared bats are thought to experience low levels of predation, and therefore, predation is not considered a threat to the species at the population level (USDI Fish and Wildlife Service 2015a).

Forest management can alter summer habitat for northern long-eared bats by removing suitable roost trees or snags, as well as changing forest structure and canopy cover. The results of forest management can be positive, neutral or negative for northern long-eared bats. In addition to habitat alteration, forest management can have disturbance impacts if bats are roosting in the vicinity, and although many bats could likely flee such disturbance, there is potential for direct mortality of bats if an occupied roost tree is felled, particularly if there are young, flightless or inexperienced bats present (USDI Fish and Wildlife Service 2015a). Forest management practices within the plan area have changed over time in that traditional methods such as clear-cutting and group selection harvest have generally transitioned to thinning prescriptions, which typically leave more trees on the landscape (see Timber Management specialist report for more details).

Prescribed burning is another form of forest/vegetation management practiced in the plan area within the range of the northern long-eared bat. Prescribed burning can alter habitat in ways similar to mechanical forest management (e.g., timber harvest), but typically, snags are left behind, which may provide some suitable foraging and roosting habitat for bats. Bats have evolved with fire, and prescribed fire can have beneficial effects on habitat, by creating snags, increasing insect forage base, and opening forest canopies. However, depending on the timing of the burns, there is potential for negative impacts as well, particularly if burns occur where maternal colonies are present. Most bats are likely able to flee a roost site threatened by fire. However spring and early summer burns could result in direct mortality of bats if non-volant (non-flying) pups, or inexperienced juvenile bats are present (USDI

Fish and Wildlife Service 2015a). Wild fires could have similar impacts to prescribed burns, although natural ignitions typically occur later in the summer. There have been no maternal colonies of northern long-eared bats documented within the plan area.

Other potential threats identified for northern long-eared bats include energy development and environmental contaminants. Wind energy facilities can cause direct mortality of bats through collision with turbines. However, to date, northern long-eared bats have rarely been documented as mortalities from wind facilities, and make up less than one percent of all known wind energy related bat fatalities (USDI Fish and Wildlife Service 2016a). There are currently no wind energy facilities on National Forest System lands within the plan area. Environmental contaminants, particularly pesticides and insecticides, can have negative impacts on insectivorous bat species, including the northern long-eared bat (USDI Fish and Wildlife Service 2015a). Insecticides and pesticides are rarely used in broad-scale applications on National Forest System lands within the range of the northern long-eared bat.

Finally, climate change has been identified as a possible driver for northern long-eared bats, since this species has been shown to be sensitive to changes in temperature, precipitation, and humidity. Climate change could potentially impact northern long-eared bats by altering habitat, affecting prey availability, and influencing the timing of hibernation and/or reproductive cycles (USDI Fish and Wildlife Service 2015a).

In listing the northern long-eared bat as a threatened species, the U.S. Fish and Wildlife Service emphasized that white-nose syndrome is the primary threat to the species. They found that outside the white-nose syndrome buffer zone, all other factors (addressed above) with potential to impact the species, “do not individually or cumulatively affect healthy bat populations” (USDI Fish and Wildlife Service 2016a).

Information Needs

There is considerable and increasing accumulation of monitoring information for northern long-eared bat for the plan area in southeast Montana and northwest South Dakota (Maxell, B., 2016, personal communication). To date there has been no verified (e.g., through genetic confirmation) presence of this species in the plan area. Continued monitoring with increased emphasis on obtaining genetic material for species confirmation would help determine whether this species actually occurs within the plan area.

The ability to detect white-nose syndrome quickly if/when it arrives within or near the plan area is a potential information need, as is a better understanding of summer maternal roosts, and/or winter hibernacula may occur. As noted previously, there are no known large caves or underground mine facilities well-suited for winter hibernacula; however, there also has been no systematic cave inventory completed for the portion of the plan area within the northern long-eared bat’s range.

Threatened and Endangered Species Not Analyzed in Detail

Introduction

The Custer Gallatin National Forest plan area spans the boundary between southeastern Montana and northwestern South Dakota. The U.S. Fish and Wildlife Service maintains field offices in each respective state, and these field offices in turn provide the list of threatened, endangered, proposed and candidate species that may be present within the plan area. However, there are a number of species on U.S. Fish and Wildlife Service lists that “may be present” but for which there are no recent, or verified observations on record within the plan area, and therefore, they were not analyzed in detail for this assessment. These species include the black-footed ferret, least tern, whooping crane and red knot.

Current Forest Plan Direction

The Custer Forest Plan indicates that the desired condition of the forest in 2035 would maintain critical habitat for black-footed ferret (page 12). Management direction regarding black-footed ferrets regards all prairie dog towns as possible black-footed ferret habitat and requires monitoring of towns before implementing control measures, surface disturbance, or reintroduction. These measures are to be implementing in ways that will not adversely affect black-footed ferret (page 17). The Gallatin Forest Plan does not mention black-footed ferret. There is no specific direction for the least tern, whooping crane or red knot in either the Custer or Gallatin Forest Plan.

Process and Methods

Lists of threatened, endangered, proposed and candidate species were obtained from the U.S. Fish and Wildlife Service Montana and South Dakota websites (listed previously in this report). Species occurrence within the plan area was assessed through inquiries of the Natural Heritage Program online databases for Montana and South Dakota. Since no occurrence records were found for black-footed ferret, least tern, whooping crane or red knot within the plan area, for purposes of this assessment, these species are summarily addressed in Table 4 below.

Table 4. Threatened and endangered species not analyzed in detail

Species	Status Listed By	Species Presence in Plan Area	Habitat Description	Habitat Presence in Plan Area
Black-footed Ferret (*Mustela negripes*)	Endangered Montana: Custer National Forest	No records in Natural Heritage Program databases for this species within existing plan area. Custer Forest Plan notes observations from 1930s in plan area (but with no supporting documentation) and from 1960s in what is now the Dakota Prairies National Grassland (no longer in plan area). In 1930s believed to be last time the species was present in existing plan area.	Prairie dog complexes in eastern Montana and western South Dakota.	Grassland and shrub-steppe habitat is present; however, existing prairie dog colonies in plan area are too small (<120 acres) to support reproductive female ferrets with young (Miller et al. 1996).
Least Tern (*Sternula antillarum*)	Endangered Montana: Custer National Forest	None; closest documented occurrence is nearly 27 miles from plan area.	Unvegetated sand-pebble beaches and islands along Yellowstone and Missouri River systems.	Summer (breeding) range does not overlap plan area (Montana Natural Heritage Program Field Guide 2016). Migratory stopovers are possible, but not documented in the plan area.
Whooping Crane (*Grus americana*)	Endangered South Dakota: Harding County	None; migratory species that may pass over plan area during migratory flights.	Marshes, stubble fields, wet meadows with roosting sites nearby.	No breeding habitat. Stopover habitat limited to grain fields on small, private inholdings within the plan area.
Red Knot (*Calidris canutus rufa*)	Threatened South Dakota: Harding County	None; nearest recorded observation (of a migratory individual) was 3.5 miles from plan area boundary, recorded in 1963.	No summer or winter habitat for this species occurs in either Montana or South Dakota. Migratory stopover habitat consists of large wetlands.	No summer or winter range; no large wetlands within plan area for stopover habitat.

Wolverine (*Gulo gulo*): Proposed for Listing as Threatened

Introduction

The North American wolverine (*Gulo gulo luscus*) was petitioned for listing under the Endangered Species Act in 2000. As a result, in February 2013 the U.S. Fish and Wildlife Service published a proposed rule to list the species as a threatened distinct population segment in the contiguous United States (USDI Fish and Wildlife Service 2013). After receiving peer review and public comments on the proposed listing, in August 2014, the U.S. Fish and Wildlife Service withdrew its previous proposal to list the wolverine as threatened (USDI Fish and Wildlife Service 2014). Then in April 2016, the United States District Court for the District of Montana remanded the matter back to the U.S. Fish and Wildlife Service for further consideration. As of May 24, 2016, the wolverine is proposed for listing and is present on the Custer Gallatin National Forest (USDI Fish and Wildlife Service 2016).

The wolverine is the largest land-dwelling member of the weasel family (Mustelidae) (USDI Fish and Wildlife Service 2013). With, large, flat feet, a compact body, and a thick, insulated coat of fur, the species is well-adapted to live in cold, snowy conditions. As such, the species occurs throughout arctic and subarctic regions, as well as boreal forests, in Eurasia and North America (Copeland et al. 2010). In North America, they are found primarily in tundra, taiga, and subalpine habitats, which, at southern latitudes, occur as extensions into the contiguous United States, and as such, are naturally more fragmented than core habitats further north in Canada and Alaska. As a result of the natural patchiness of habitat in the continental United States, wolverine populations occur at lower densities as well (Ruggiero et al. 2007). Wolverine habitat in the continental United States is found at higher elevations, generally above 2,100 meters (6,800 feet). Wolverines are thought to select higher elevation habitats to avoid high temperatures in summer (USDI Fish and Wildlife Service 2013). At a finer scale, high elevations provide deep snow that persists well into spring months, and this condition appears crucial to females in the selection of reproductive den sites (Ruggiero et al. 2007).

Many female wolverines are capable of giving birth at 2 years of age, but average age at first reproduction is likely 3 years. Breeding typically takes place in late summer to early fall, but implantation of fertilized eggs is delayed until winter or spring. Kits are born in February or March, with an average litter size of one to two (USDI Fish and Wildlife Service 2013). Once kits are weaned in late April or May, the natal den is usually abandoned (Copeland et al. 2010). Although most female wolverines are capable of reproduction by age 3, high energetic demands associated with pregnancy in a harsh unproductive environment result in loss of pregnancy for about half the reproductive population each year. Consequently, wolverines have one of the lowest reproductive rates of any mammal (USDI Fish and Wildlife Service 2013).

Wolverines have the foraging strategy of an opportunistic omnivore, and feed on a variety of food sources depending on availability. They are primarily scavengers, seeking out ungulate carrion, but will also prey on small mammals and birds, as well as consume insects, berries and/or other fruity plants if available (USDI Fish and Wildlife Service 2013). This adaptive foraging strategy allows wolverines to persist in an otherwise hostile (i.e., cold, unproductive) environment. The combination of naturally fragmented habitat, low productivity in the environment, and low reproductive rates, result in very sparse population densities for wolverines across their range (Inman et al. 2013).

Home range sizes for most mammals are associated with body size, and individuals living in less productive habitats typically have larger home ranges. This association holds true for wolverines, and as inhabitants of harsh, relatively unproductive environments, their home range size is large relative to their body mass. Home range sizes for wolverines in the Greater Yellowstone Ecosystem, which includes the Custer Gallatin National Forest plan area, average about 303 kilometers (117 square miles) for independent females (i.e., without young), and about 797 square kilometers (308 square miles) for adult males. Females with dependent young still have a fairly large annual home range size, reported at a minimum of about 100 kilometers (38 square miles). These large home ranges of wolverines often cross multiple administrative boundaries (e.g., National Forest, National Park, BLM, etc.). Minimal overlap (typically less than 2 percent) between home ranges of adult wolverines of the same sex indicates territoriality. Finding adequate resources and maintaining large territories requires long-range movements. Males travel two to three times further than females on average, but both sexes frequently move distances equivalent to the diameter of their home range in just a couple of days, often covering a distance equal to the perimeter of their home range in less than a week. Juveniles disperse from their mother's home range, starting at about eleven months of age. Genetic profiles of different wolverines indicate that dispersals of up to 500 kilometers (310 miles) are possible (Inman et al. 2011).

Given the natural patchiness of wolverine habitat in the continental United States, coupled with the species' capacity for long-range movement, it is likely that wolverines in the lower 48 states exist as a metapopulation, which is basically a network of sub-populations occupying isolated patches of suitable habitat, separated by sometimes vast expanses of unsuitable habitat (USDI Fish and Wildlife Service 2013). Due to the wolverine's selection of remote, harsh environments and associated low density occurrence on the landscape, population demographics are difficult to monitor. However, what is clear is that their persistence in the naturally fragmented habitat found at the southern edge of their range is vitally dependent on regular, or at least intermittent, dispersal of individuals between habitat islands to facilitate gene flow between sub-populations (Ruggiero et al. 2007).

Process and Methods

This assessment was based on current best available science, much of which was compiled by the U.S. Fish and Wildlife Service and published in the *Federal Register* as findings relative to the wolverine's Federal status (USDI Fish and Wildlife Service 2013, 2014). In addition to published science, local surveys and monitoring results informed this assessment relative to wolverine occurrence and distribution in the plan area. GIS technology was applied to quantify and evaluate potential wolverine habitat in the plan area, using modeling criteria developed by Copeland and associates (2010) along with Inman and others (2013).

Scale

The wolverine occurs throughout the arctic, subarctic, alpine, and subalpine regions of Eurasia and North America. The southern part of the range in North America includes the mountainous regions of the western United States (Copeland et al. 2010), including the Greater Yellowstone Ecosystem, which covers much of the Custer Gallatin National Forest plan area. The Greater Yellowstone Ecosystem for wolverine is an area roughly 108,000 square kilometers (41,700 square miles) in size, composed primarily of public lands including the Yellowstone plateau and surrounding mountain ranges in Montana, Idaho and Wyoming (Inman et al. 2011). Another area important for wolverines has been coined the "Central Linkage Region" by Inman and associates (2013). The Central Linkage Region consists of relatively small patches of suitable wolverine habitat found in a number of isolated mountain ranges located between the larger contiguous blocks of wolverine habitat. The Central Linkage Region includes the Bridger, Bangtail and Crazy Mountain Ranges of the Custer Gallatin National Forest, as well as other small mountain ranges to the north and west (e.g., the Belts, Anaconda/Pintler, and Gravelly Ranges). Collectively, the Central Linkage Region is roughly the same scale as the Greater Yellowstone Ecosystem, but wolverine habitat is much more patchily distributed, primarily on public lands at higher elevations within the mountainous areas, which are separated by intervening valley bottoms and lowlands, much of which are held in private ownership (Inman et al. 2011). In the plan area, wolverine habitat is located in the Montane Ecosystem. The Madison, Gallatin, Absaroka and Beartooth, landscape is part of the Greater Yellowstone Ecosystem, whereas the Bridger, Bangtail, Crazy Mountain landscape is part of the Central Linkage Region for wolverines. The Pryor Mountain landscape has some, albeit very marginal quality wolverine habitat. Collectively, these landscapes of the Custer Gallatin National Forest cover a total area just shy of 4,300 square miles. Unless otherwise specified, this assessment considered wolverine issues at the scale of the continental United States, or subsets therein as defined above.

Existing Information

Until recently, wolverines were one of the least-studied carnivores in North America, particularly in the continental United States, which has very low density populations that are difficult to monitor. The species was petitioned for listing at the turn of the 21st century, which prompted new research on wolverine distribution, ecology, and interactions with humans (Ruggiero et al. 2007). Even with this new research, there is no reliable historic or current population census for wolverines in the continental United States, so there is uncertainty in population and trend estimates; however, it is widely accepted that wolverine densities are naturally low in areas where they occur within the lower 48 states (USDI Fish and Wildlife Service 2013). Demographic information for wolverines is difficult to obtain due to low densities and the species' natural affinity for remote and rugged environments with limited access (Squires et al. 2007). Information is lacking on key population characteristics such as distribution of reproductive females; therefore population estimates and trajectories are based on very limited information (Inman et al. 2013).

Current Forest Plan Direction

Neither the Custer nor Gallatin existing plans provide direction specifically addressing wolverines or their habitat. However, the Custer Plan defines a biological evaluation as "a review of all Forest Service planned, funded, executed or permitted programs and activities for possible effects on endangered, threatened, proposed or sensitive species" (chapter VI, page 123). Prior to being proposed for listing under the Endangered Species Act, the wolverine was identified as a Forest service sensitive species, known to occur on both the Custer and Gallatin administrative units. Direction for management of sensitive species is contained in the Forest Service Manual (FSM) which mandates that the agency "avoid or minimize impacts to species whose viability has been identified as a concern", and that "decisions must not result in loss of species viability or create significant trends toward federal listing" (FSM 2670.32). Because sensitive species designation resides with the Regional Forester, and since the list of species is dynamic, individual forest plans are not amended each time a species is added or removed from the Regional sensitive species list. Both the Custer and Gallatin plans contain glossaries, which define sensitive species as: "those plant or animal species which are susceptible or vulnerable to activity impacts or habitat alterations." The Custer Plan contains a management standard that "areas of unique plants and animals will be identified and all activities will be managed to retain habitat for these species" (page 20). The Gallatin Plan (as amended 2015) includes a Forest-wide standard that "habitat for Regionally designated sensitive species on the Gallatin NF will be maintained in a suitable condition to support these species (page II-19).

Existing Condition

Population

Based on existing habitat conditions, Inman and associates (2013) predicted habitat capacity for about 644 individuals in the continental United States, and estimated the current population to be at about half capacity, which is consistent with U.S. Fish and Wildlife Service population estimates of 250 to 300 individuals for the continental United States Distinct Population Segment for the species (USDI Fish and Wildlife Service 2013). Over half the population capacity in the continental United States is located in the Greater Yellowstone, Salmon-Selway, Central Linkage, and Northern Continental Divide ecosystems. The Custer Gallatin National Forest plan area covers parts of both the Greater Yellowstone and Central Linkage Region for wolverines. Inman et al. (2013) estimated population capacity for the Greater Yellowstone Ecosystem at approximately 146 animals, with a current population estimate of about 63 individuals, and estimated the Central Linkage Region capacity and current population at approximately 50 animals. No estimate is available for the number of wolverines that occupy the plan area. However, estimates at the larger (ecosystem) scale equate to approximately 3.5 wolverines per 1,000 square kilometers (386 square miles) of suitable habitat (Inman et al. 2013). Based on criteria developed by Inman and associates (2013), the Custer Gallatin National Forest contains approximately 2,730 square miles of primary (i.e., suitable) wolverine habitat (see Figure 7). Accordingly, if suitable habitat on the Custer Gallatin National Forest were fully occupied, we would expect no more than 25 wolverines to occur in the plan area.

Significant genetic diversity has been found in subpopulations of wolverines, indicating low migration rates and at least some degree of geographic isolation between subpopulations (Aubry et al. 2007). Male-dominated dispersal and female tendencies to remain closer to their birth areas are thought to contribute to this genetic structuring of wolverine populations (Squires et al. 2007). The U.S. Fish and Wildlife Service (2013) noted that, since the species was nearly extirpated early in the 20th century, the current wolverine population in the continental United States appears to be increasing. However, they also speculated that there could be founder effects associated with population growth linked to relatively few dispersers from Canada.

Distribution

The U.S. Fish and Wildlife Service considers the current range for wolverines in the continental United States Distinct Population Segment to include suitable habitat in the Northern Cascade Mountain Range in Washington state, the northern Rocky Mountains in Idaho, Montana, Wyoming and eastern Oregon, and the southern Rocky Mountains of Wyoming, Colorado, and California (USDI Fish and Wildlife Service 2013). However, current known distribution of the species is limited to north-central Washington, the Wallowa Mountains of Oregon, northern and central Idaho, western Montana and northwestern Wyoming (Aubry et al. 2007; USDI Fish and Wildlife Service 2013). In the plan area, wolverines are known to occur in the Madison, Gallatin, Abasorka and Beartooth landscape of the Greater Yellowstone Ecosystem and the Bridger, Bangtail, Crazy Mountain landscape of the Central Linkage Region. The Pryor Mountains are the only landscape within the Montane Ecosystem for which neither wolverine occupancy nor presence of primary habitat has been documented. However, Inman and others (2013) noted that the Pryor Mountains may serve as dispersal habitat for males, but not likely for female wolverines.

Habitat Requirements and Conditions

The best available scientific information indicates a very strong association between wolverines and cold temperatures, persistent snow conditions, and relatively high elevations across the landscape (Aubry et al. 2007; Ruggiero et al. 2007; Copeland et al. 2010; Inman et al. 2011, 2013; and McKelvey et al. 2011). Whereas wolverines appear to be habitat generalists in terms of vegetative conditions, cooler temperatures in both summer and winter, along with deep snow that persists well into spring appear to be key habitat components. These conditions provide an ecological niche in which wolverines can avoid competition for resources with other predators. Snow is also seemingly crucial to wolverine reproductive habitat, in that the vast majority of known reproductive den sites world-wide are associated with deep snow conditions that provide thermal insulation as well as protection from predators for wolverine kits. Snow and cold are also thought to play a role in the wolverine's foraging strategy in that they are known to scavenge winter killed ungulates such as mountain goats (*Oreamnos americanus*), and cache food in the snow for long-term use. Ninety-four percent of wolverine habitat in the contiguous United States is within Federal ownership, most of which is managed by the Forest Service. Of that, a considerable portion is found in protected areas including designated wilderness and inventoried roadless areas (33 percent and 16 percent respectively) (USDI Fish and Wildlife Service 2013).

In the Greater Yellowstone Ecosystem, wolverines show most consistent use in areas at least 2,600 meters (8,530 feet), and basically avoid areas below 2,150 meters (7,050 feet) in elevation. They are typically found at or above tree-line in summer and shift to slightly lower elevations, usually right around tree-line, in winter. Although wolverines move to slightly lower elevations in winter, they still typically stay above 2,450 meters (8,040 feet) and may even range up to 3,050 meters (10,000 feet). This elevation band is well above the areas that typically provide winter range for most big game species, where large concentrations of elk and other species provide abundant scavenging opportunities. At these high elevations, snow persists in patches well into the summer months, lending to a very brief growing season and resulting in low vegetative productivity. Wolverines have apparently adapted to a trade-off between highly productive environments and low predation risk and competition from other predators (Inman et al. 2011).

Genetic structuring among wolverine sub-populations supports a theory that snow cover is important for dispersing individuals as well, indicating that successful dispersals (i.e., individuals lived to reproduce) were linked to paths within areas of persistent snow cover (Copeland et al. 2010; McKelvey et al. 2011). Given the species' morphological adaptations for efficient travel over snow, it is not surprising that snow conditions may facilitate travel (Inman et al. 2011). Parks and others (2012) showed that genetic relatedness of wolverines diminished with distance between core populations, and noted that wolverines from the Greater Yellowstone Ecosystem showed limited genetic connectivity to the rest of the continental United States Distinct Population Segment. They suggested that geographic isolation of the Greater Yellowstone Ecosystem population is due to conditions associated with connecting corridors, which for the Greater Yellowstone Ecosystem are long, located at lower elevations, and frequently cross areas of human development. Wolverines are capable of long distance movements, including travel through human developments and otherwise altered habitat, but appear to prefer to move across suitable habitat, which is defined by persistent snow cover (USDI Fish and Wildlife Service 2013). Inman and others (2013) noted that there is no evidence that wolverine dispersal is currently being restricted by human development to a degree that negatively affects metapopulation functionality. However, they also cautioned that there may be a limit to the wolverine's willingness and capability to travel through increasing human development.

Copeland and associates (2010) used satellite imagery to build a coarse filter map of potential wolverine habitat on a global scale, by indicating where snow was consistently present through the end of the reproductive denning season (through May 15). Inman and others (2013) then produced a more fine-scale resource selection model to predict suitable habitat for wolverine survival, reproduction and dispersal. Results from these two models were a good match to known wolverine distribution for the northern Rockies, the Greater Yellowstone Ecosystem and the Custer Gallatin National Forest plan area. Parameters from these two models were used to quantify, evaluate and display potential wolverine habitat within the plan area. The Custer Gallatin National Forest plan area covers roughly 4,286 square miles of land (aka the Montane Ecosystem) that contains potential wolverine habitat. Of this, approximately 62 percent was modeled to have persistent snow coverage (per Copeland et al. 2010) for the period 2000 to 2006. Inman and others (2013) defined primary wolverine habitat as that suitable for long-term survival (i.e., residential use by adult animals). Roughly 64 percent of the Montane Ecosystem within the plan area meets the criteria for primary habitat. Within the primary habitat approximately 35 percent of the Montane Ecosystem meets the criteria for maternal (i.e., reproductive denning) habitat as defined by Inman and others (2013). Finally, Inman and associates modeled dispersal habitat for both male and female wolverines. The entire Montane Ecosystem of the plan area is suitable for male dispersal, and about 90 percent is suitable for female dispersal. These habitat components are broken out by familiar landscape areas below. Figure 7 displays wolverine habitat as defined by Copeland et al. (2010) and Iman et al. (2013) within the plan area.

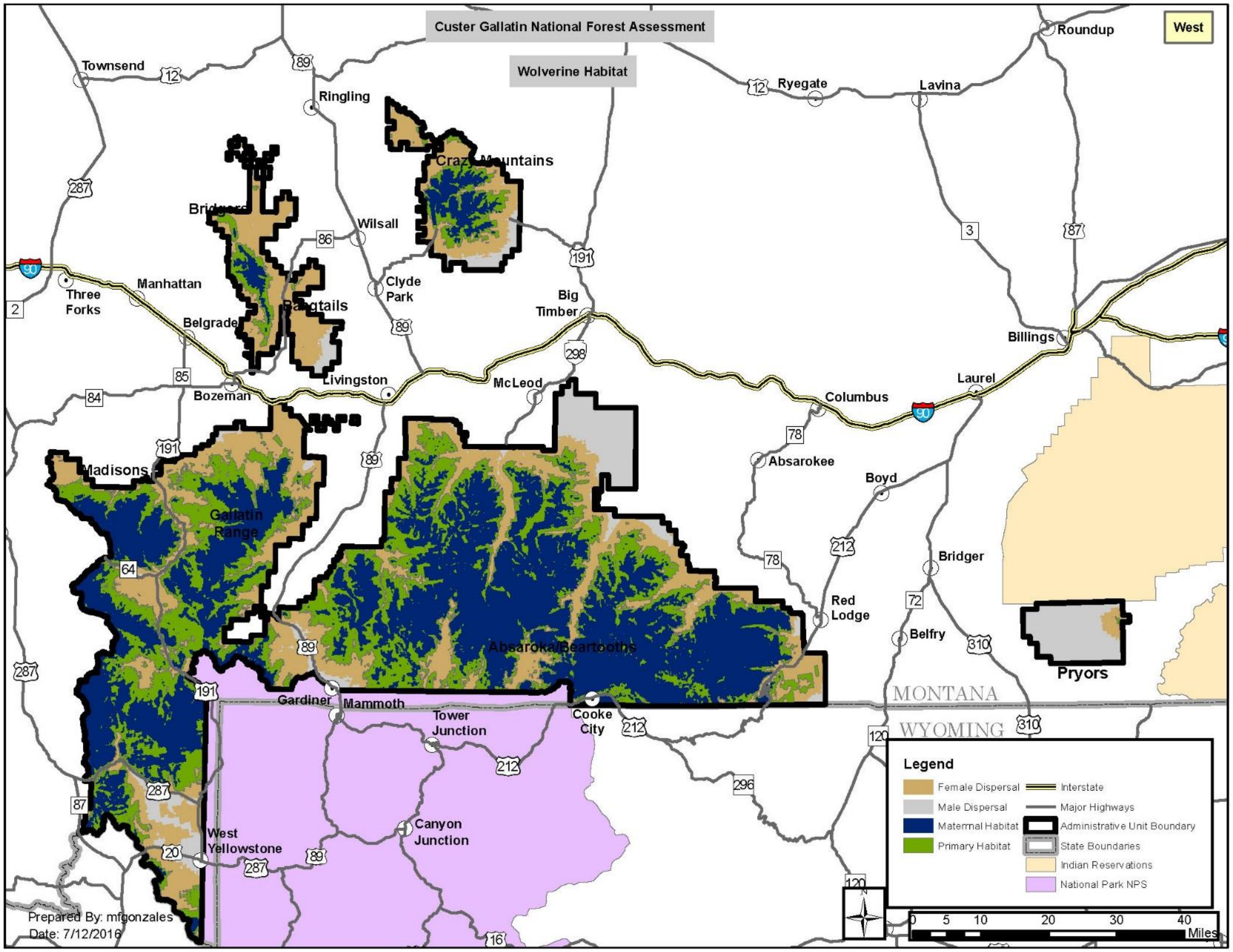

Figure 7. Wolverine habitat distribution in the plan area

Sources: Copeland et al. (2010), Inman et al. (2013).

Madison, Henrys, Gallatin and Absaroka Beartooth Mountains

This landscape area is within the Greater Yellowstone Ecosystem and wolverine presence has been documented within the mountain ranges making up this landscape on a regular basis. Approximately 70 percent of this landscape meets the criteria for primary wolverine habitat, and 66 percent was modeled to have persistent snow cover from the year 2000 to 2006. Roughly 39 percent is predicted to provide suitable maternal denning habitat. Nearly all (93 percent) is within female dispersal range, whereas the entire landscape is suitable for male dispersal. A large proportion of this landscape is within protected areas such designated wilderness, recommended wilderness, wilderness study area and/or inventoried roadless areas (see the general wildlife section above for more information on protected areas). The Greater Yellowstone Ecosystem has been identified as one landscape in the continental United States predicted to experience less snow loss due to climate change, and therefore this landscape could contribute to the maintenance of long-term refugia for wolverines in the future (Copeland et al. 2010; McKelvey et al. 2011; Inman et al. 2013; and USDI Fish and Wildlife Service 2013).

Bridger, Bangtail, and Crazy Mountains

This landscape is part of the Central Linkage Ecosystem for wolverines, which has been identified by Inman and others (2013) as highly important area for metapopulation persistence, because its position on the landscape may provide habitat connectivity and linkage between large islands of suitable wolverine habitat. Wolverines have been detected in recent years, but are believed to persist at extremely low levels in this landscape. Roughly 47 percent of this landscape was modeled to have persistent snow (2000 to 2006), yet only 31 percent meets the criteria for primary habitat and 12 percent for maternal denning purposes. The majority (86 percent) of the landscape is within predicted female dispersal range, whereas the entire landscape appears suitable for male dispersal. The Central Linkage Region is made up of a number of relatively small, isolated mountain ranges, with even smaller patches of potentially suitable (primary) wolverine habitat (Inman et al. 2013). The Bridger/Bangtail/Crazy Mountain landscape is just a small part of this region for wolverines, but could play an important role for metapopulation persistence if occupied by reproductive females.

Pryor Mountains

This landscape is made up of a very small, isolated mountain range located near the northern tip of the Bighorn Mountain Range in Wyoming. While there are very small amounts of potentially suitable habitat for wolverines in the Pryor Range (19 percent persistent snow layer, less than 1 percent primary habitat, and no maternal habitat), there has been no historic or recent documented occurrence of the species in this landscape. The current population estimate for the Bighorn Range is zero, and due the extreme geographic isolation of this range, there is likely very low if any, probability of naturally occurring female dispersal to this area (Inman et al. 2013). While the Pryor landscape is entirely within the predicted male dispersal range, only about 9 percent is within predicted female dispersal habitat. Therefore, contribution of this landscape to wolverine conservation over time is unknown, but thought to be quite low.

Ashland District

This landscape is at lower elevation, and does not provide snow conditions that present suitable habitat for wolverines.

Sioux District

This landscapes does not contain suitable habitat for wolverines.

Key Benefits to People

Wolverines are considered a furbearer in Montana, and although the trapping season is currently effectively closed, it could be re-opened under the right circumstances. Given the low density occurrence of wolverines in the plan area, it is unlikely the sale of wolverine pelts has ever been significant contributor to local economies. However, fur trapping is sanctioned by the state, and part of the western culture that is still practiced and appreciated by some. Like many activities that occur on National Forest System lands, fur trapping is contentious.

Like the grizzly bear and lynx, for many, the wolverine is symbolic of ferocity, tenacity, and persistence. Knowing that this animal can survive in such remote, harsh, and rugged conditions brings a sense of wonderment to some people. For some individuals, the presence of wolverines indicates successful conservation of wild areas in a natural state, relatively free of negative influence from humans.

Trends and Drivers

Wolverine occurrence in the continental United States has been documented back to 1801. Given the naturally fragmented habitat for wolverines at the southern extent of their range, it is likely that the species has always occurred at low densities, and that historic populations in the continental United States were low. The species was extirpated, or nearly so, from the continental United States by the 1930s due to unregulated trapping and predator control (Aubry et al. 2007; USDI Fish and Wildlife Service 2013). European settlers treated wolverines as vermin, because they stole fur-bearers from traplines, raided cabins and other settlements for food, and damaged or destroyed property by spraying musk or urine. Wolverines were also thought to be ferocious, and therefore potentially dangerous animals. At the time of early settlement within the lower 48 states, trapping and/or poisoning of predators was a common practice to protect domestic livestock and big game species as well (Aubry 2007).

Montana has historically been a stronghold for wolverines in the continental United States, but even here, there were no verifiable records of wolverines between 1921 and 1930. Early research suggests that wolverines dispersing from Canada began to recolonize in Montana between 1930 and 1950, while there were few if any verified records from other states until about 1960 (Aubry 2007). Since wolverines began to reestablish, Montana has been the only state in the lower 48 to allow trapping of this species. Up until 1975, wolverines were classified as a predator in Montana, with unlimited harvest. From 1975 to 2004, wolverines were classified as fur-bearers, with regulated harvest of one animal per trapper. In 2004, Montana established a total annual harvest limit of twelve wolverines (Squires et al. 2007). Montana trapping regulations were adjusted again in 2008 reducing the statewide harvest limit to five wolverines, and wolverine harvest was prohibited in the smaller, insular mountain ranges in the central part of the state; i.e. within the Central Linkage Region (Giddings 2014). In November 2012, a district court issued a restraining order barring the opening of Montana's trapping season for wolverines, and the season has remained effectively closed with a harvest quota of zero since (USDI Fish and Wildlife Service 2013). There is no doubt that wolverine populations can be affected by human persecution through trapping and predator control, and it appears that no other human activity has the same potential to limit wolverine populations (Ruggiero et al. 2007; Copeland et al. 2010). Squires and others (2007) reported legal and incidental (unintentional) trapping of wolverines as additive mortality in the early 21st century. However, the U.S. Fish and Wildlife Service determined that the small amount of legal trapping in Montana, combined with incidental trapping in Montana and surrounding states, by itself is not a threat to the wolverine distinct population segment, and state records show an increasing population of wolverines since the species became re-established (USDI Fish and Wildlife Service 2014).

Wolverines have historically and currently shown an affinity for high elevation, remote, often harsh environments where resources are limited by low productivity, temperatures can be extreme, and access is often difficult due to rugged terrain as well as deep, persistent snow throughout a significant proportion of the year. A possible explanation for this habitat selection strategy is to avoid competition with, and predation by, other more generalist predators. Populations of two notable predators, grizzly bears (*Ursus arctos*) and gray wolves (*Canis lupus*) have increased in the Greater Yellowstone Area in recent years and continue to expand, which could have impacts on wolverine populations if species overlap results in competition for resources or direct mortality of wolverines (Inman et al. 2011)

Historically, wolverines were distributed across the northern tier of the continental United States (USDI Fish and Wildlife Service 2013), with population centers in the Pacific Coast Mountains, the Rocky Mountains, Upper Mid-west and Northeast (Aubry et al. 2007). The southern limit of the species is thought to have been northern New Mexico. Wolverine distribution in the western mountains was historically associated with alpine vegetation and associated high-elevation climate. However, the single habitat component that best predicted historical distribution patterns was spring snow cover. All historic records of wolverines in the western states, and nearly all in the eastern states were from locations with a good probability of snow cover during the reproductive denning period (Aubry et al. 2007). Lack of spring snow cover could affect wolverine distribution by limiting the availability of suitable denning habitat (Copeland et al. 2010).

Wolverine distribution had contracted substantially by mid-20th century, with the most notable losses in the eastern and southern parts of their historical range. By about the 1960s, wolverine distribution was limited to the Pacific Coast Range and the Rocky Mountains, with only two verifiable occurrences east of the Rockies between 1960 and 1994 (Aubry et al. 2007). Wolverine distribution has been associated with remote locations, and at times this has been correlated with avoidance of human disturbances. However, historic records of wolverines in the continental United States have all been associated with high elevation, alpine, subalpine, and/or relatively cold climatic conditions. One study that specifically investigated wolverine distribution relative to human occupation (May et al. 2006 *in* Copeland et al. 2010) showed notable separation of the species at a broad scale, but at a finer scale, found little evidence indicating avoidance of humans by wolverines (Copeland et al. 2010). Therefore, while human disturbance has regularly been submitted as a factor limiting wolverine distribution, it is possible that the ecological niche occupied by wolverines—high elevation, rugged terrain with significant snow accumulation and persistence—naturally isolates them from the human developments typically located in more hospitable environs (Inman et al. 2011; USDI Fish and Wildlife Service 2013).

The best available scientific information shows a strong association between wolverine occurrence and deep persistent snow cover, particularly during the reproductive denning season. Significant reductions in spring snow cover due to warming climate conditions have already been recorded in portions of the wolverine's range. If persistent spring snow is in fact a requirement for suitable reproductive denning habitat, then continued warming trends are expected to reduce this habitat component, which could ultimately have associated impacts on wolverine distribution in the continental United States (Copeland et al. 2010). However, the U.S. Fish and Wildlife Service found that in light of recent reductions in spring snow cover, the best available information does not show that climate change thus far has resulted in any notable shrinkage of wolverine habitat (USDI Fish and Wildlife Service 2014).

McKelvey and others (2011) noted that boreal species such as the wolverine are strongly associated with the amount, distribution, and persistence of snow, and therefore may be particularly sensitive to changes in snow cover expected to occur as a result of climate change. Potential impacts could result from loss of snowpack for reproductive den sites, warmer temperatures affecting the wolverine's capacity for thermoregulation, lack of snow and cold for preserving food caches, and/or loss of habitat connectivity (Copeland et al. 2010). McKelvey and associates (2011) used sophisticated modeling techniques to predict climate change impacts to wolverine habitat. Model results showed significant loss of spring snow cover by the end of the 21st century, and based on these results, the authors expected shifts in wolverine distribution and connectivity. This study identified a few possible sites that are most likely to retain persistent snow cover throughout the 21st century, including the Greater Yellowstone Area, where the majority of suitable wolverine habitat in the Custer Gallatin National Forest plan area is located. Although the Greater Yellowstone Area was identified as an area likely to retain persistent snow cover, wolverine habitat in the Greater Yellowstone Area is expected to become more fragmented with climate change. McKelvey et al. (2011) also predicted that by about year 2070, important dispersal corridors connecting the Greater Yellowstone Area wolverine population to other core areas such as Glacier National Park and the Bob Marshall Wilderness complex in northwest Montana, would shift to the east, assessing greater import to the Bridger/Bangtail/Crazy Mountain landscape in the plan area for wolverine habitat connectivity.

Indeed, changes in snowpack in the continental United States have already been correlated with climate change, and in 2013, climate change was identified by the U.S. Fish and Wildlife Service as the primary threat to the distinct population segment of wolverine in the continental United States. There is significant evidence that the climate is changing in ways that affect snow accumulation, and that distribution of wolverine habitat will continue to shift due to climate change. However, the potential for impacts to wolverines resulting from such change is highly speculative, and consequently the subject of major discourse. Ultimately, the uncertainty associated with causal relationships between climate change, habitat conditions, and wolverine response, led the U.S. Fish and Wildlife Service to withdraw their proposal to list the North American wolverine as threatened in the continental United States Distinct Population Segment (USDI Fish and Wildlife Service 2014). However, in 2016 a United States District Court remanded that decision back to the U.S. Fish and Wildlife Service for consideration. Therefore, as of the date of this assessment, the Wolverine Distinct Population Segment is again proposed for listing under the Endangered Species Act (USDI Fish and Wildlife Service 2016).

While climate change may be one of the most prolific, and perhaps controversial topics of potential trends and drivers of wolverine habitat, it is not the only subject addressed in the literature. Scientists and others have questioned whether resource extraction activities such as timber harvest, recreation use such as back-country skiing and snowmobiling, roads and associated human access, and rural sprawl might have the potential to impact wolverines and/or their habitat (Ruggiero et al. 2007; Inman et al. 2011). The U.S. Fish and Wildlife Service found that while human development and use undoubtedly has some effect on wolverines and likely has resulted in minor losses of wolverine habitat, the amount of loss and associated effect to the species has yet to be quantified. Since wolverines select habitat that is remote, and thus generally uninviting for human use and occupation, there has been limited overlap between permanent human developments and high human use areas with primary wolverine habitat. The majority of wolverine habitat is public land under Federal management that is largely protected from permanent human alteration, including considerable portions of wolverine range within designated wilderness, or other areas where land management activities are largely restricted. Most land management activities occur on a small scale relative to the size of a wolverine's home range and few negative effects to wolverines have been directly associated with management actions such as livestock grazing, timber management or prescribed fire (USDI Fish and Wildlife Service 2013).

Given the strong association between wolverine habitat and snow cover, winter recreation uses (such as skiing and snowmobiling) are likely activities to consider for impacts. Winter time human disturbance at wolverine reproductive den sites has been documented to result in den abandonment. However, such incidents appear rare, and there are also reported incidents of human disturbance at den sites that were not abandoned (USDI Fish and Wildlife Service 2013). Some research has shown a negative correlation between winter recreation use and wolverine occurrence; however, causality has not been confirmed (Ruggiero et al. 2007). On the other hand, wolverines have been documented to occur in areas of high human disturbance, including developed ski areas and snowmobile use areas (USDI Fish and Wildlife Service 2013). Heinemeyer and associates (1999, 2001, and 2012, cited in USDI Fish and Wildlife Service 2014) investigated potential impacts to wolverines from high levels of winter recreation use (backcountry skiing and snowmobiling) in the Greater Yellowstone Area, where there was substantial overlap between maternal denning habitat and high human use areas. This research showed that wolverines tolerated winter use by humans, but exhibited behavioral responses that could impact energy reserves. However, there was no direct evidence of negative impacts to wolverines from winter recreation. Further, the areas with consistent, high concentrations of human use represented only a small proportion of the Greater Yellowstone Area. The U.S. Fish and Wildlife Service found no evidence that winter recreation has a negative effect on wolverines (USDI Fish and Wildlife Service 2013, 2014). There are currently five developed alpine ski areas within the plan area boundary, three of which operate entirely on private land, while the other two operate extensively on National Forest System lands. In addition, there are three Nordic resorts that have groomed ski trails on National Forest System lands in the plan area. Numerous additional trails are groomed for back-country ski and/or snowmobile use depending on conditions, and many more miles of ungroomed trails, plus dispersed play areas open to back-country skiing and/or snowmobiling. Winter recreation use levels have been increasing in the plan area in recent years due to a steadily growing human population, coupled with improved technology that provides easier access into remote areas (see Recreation specialist report for more details).

Some research has indicated a negative relationship between roads and wolverine occurrence. While there may be a correlation, it could be due to fact that the remote, rugged terrain selected by wolverines is not conducive to road development. Wolverines have been shown to avoid major transportation routes (high volume, high speed vehicle traffic) in their daily movements. However, dispersing wolverines have been known to successfully cross major transportation routes, although there have also been documented wolverine mortalities due to vehicle collision along such routes. Most roads in high quality wolverine habitat are low-volume, low speed, dirt or gravel roads not likely to cause wolverine avoidance (USDI Fish and Wildlife Service 2013). Forest roads have not been associated with wolverine mortality due to vehicle collisions to our knowledge. Snowmobile routes, which are often coincident with forest roads, provide access for fur trappers. Although the trapping season for wolverines is currently closed, there have been a few cases of incidental capture of wolverines in traps set for other furbearer species (USDI Fish and Wildlife Service 2013). Finally, Inman and others (2011) identified increasing human infrastructure and rural sprawl as potential stressors on wolverine habitat connectivity. However, the U.S. Fish and Wildlife Service concluded that current best science does not show that wolverines avoid human developments, nor is there any empirical evidence that wolverine dispersal is negatively affected by human infrastructure (USDI Fish and Wildlife Service 2013).

Information Needs

Although research on wolverines and their habitat needs has increased in recent years, the wolverine is one of the most rare and least studied mammals in North America. Its propensity for remote, rugged terrain, and very low density of occurrence makes it difficult to even observe, let alone monitor and/or study the wolverine (Aubry et al. 2007). As a result, information regarding the species, its ecology, and demographic trends remain relatively sparse compared to other species (Ruggiero et al. 2007; Copeland et al. 2010; Inman et al. 2011; McKelvey et al. 2011; and USDI Fish and Wildlife Service 2014).

The most glaring information need for this species is whether, when, and how climate change could affect the wolverine. There is substantive evidence that warming temperatures have already, and will continue to affect wolverine habitat. The questions remaining are how habitat will be affected in the future, and more importantly how individual wolverines will respond to changes induced by climate fluctuation, and ultimately, how all of this might affect the wolverine population and its ability to persist. Currently, there are multiple, competing theories regarding potential impacts from climate change, resulting in professional disagreement and scientific uncertainty (USDI Fish and Wildlife Service 2014). We believe that habitat simulation models presented by Copeland et al. (2010) and Inman et al. (2013) provide the best available scientific information regarding existing wolverine habitat suitability and distribution. However, these models are based on limited information, as noted by the authors. McKelvey and associates (2011) provided an assessment of potential impacts to wolverines based on global climate models, incorporating temperature and precipitation, as well as calibrating for topography and regional climate conditions in the continental United States. They noted that their predictions were based on a number of assumptions, developed at a relatively coarse scale, and that they were unsure how fine-scale changes in snow and temperature may affect individual wolverines and/or species persistence.

In addition to questions about climate change, there is still a need for additional information regarding wolverine response to human disturbance and development, specific requirements for reproductive denning habitat, thermoregulatory capability (e.g., information on the upper temperature limits), dispersal timing and associated habitat needs, plus better information on existing population numbers and distribution.

Key Findings

- Wolverines are medium-sized carnivores, whose range includes arctic and subarctic regions, as well as boreal forest environments.
- Historically and currently, wolverine distribution has been strongly associated with persistent snow cover that lasts well into the spring, and even summer months at higher elevations.
- At southern latitudes, wolverine habitat is naturally more patchily distributed than core habitat to the north, and as a result, wolverine populations in the contiguous United States occur at low densities.
- Wolverines have large home ranges and are capable of long-range movement, with dispersals of up to 300 miles reported. As such, these animals operate at a scale that typically crosses multiple administrative boundaries.
- Wolverines are known to travel across lowlands, including through human developments, but appear to prefer to move through higher elevation, often snow-covered terrain.
- The harsh, low-productivity environments selected by wolverines appear to have a low carrying capacity and subsequent low densities of wolverines, but may offer a trade-off of reduced competition and/or predation from other carnivores.
- The high correlation between wolverine distribution and persistent snow cover has raised concern for impacts to wolverines due to potential habitat loss associated with climate change. While the science associated with climate change shows strong support for predicted reductions in snow cover, the correlation between such changes and wolverine response is still a subject of much debate.

- There is little evidence of impacts to wolverine populations associated with human activities, other than direct impacts associated with unregulated fur trapping. Montana is the only state in the contiguous United States that allows trapping of wolverines; however, in recent years the state wolverine harvest quota has been set to zero.

At-Risk Species: Potential Species of Conservation Concern

Introduction

The 2012 Planning Rule established species of conservation concern, which are defined as “species, other than federally recognized threatened, endangered, proposed, or candidate species, that are known to occur in the plan area and for which the Regional Forester has determined that the best available scientific information indicates substantial concern about the species’ capability to persist over the long-term in the plan area” (36 CFT 219.9 (c)). The existing forest plans operate under a policy for sensitive species, which are “those plant and animal species identified by a Regional Forester for which population viability is of concern” (FSM 2670.22). Both categories were established in order to maintain viable populations of species on National Forest System lands. The 2012 rule notes that Regional Forester sensitive species are similar to species of conservation concern, but concludes that the shift to species of conservation concern is more focused than the emphasis on sensitive species under the viability provisions of the 1982 rule. Sensitive species include all vertebrate species, for which population viability is a concern, regardless of whether there is substantial concern for persistence of the species in the plan area. Species of conservation concern include invertebrate species as well. Species of concern must be native to, and known to occur in, the plan area, whereas sensitive species could include non-native species, and/or species for which presence in the plan area is only suspected due to habitat capability.

Since many species are wide-ranging, and often occur on multiple administrative units, the 2012 rule allows the Regional Forester to coordinate with the responsible official to identify species of conservation concern known to occur in the plan area, and for which the best science indicates substantial concern for persistence within that plan area. This approach is designed to increase consistency across administrative units and build efficiency into the Agency’s collective efforts to maintain the diversity of plant and animal communities (*Federal Register* 77(68): 21175, April 9, 2012). The 2012 rule requires the responsible official to identify potential species of conservation concern for the plan area, and to assess existing information for those species in the assessment (36 CFR 219.6 (b)(5)).

Process and Methods

The process for identifying potential species of conservation concern followed the steps outlined in the Directives that describe in detail how the 2012 Planning Rule is to be implemented. For identification of potential species of conservation concern, these directives are found in FSH 1909.12.52. The first step was to determine which species are native to, and known to occur in, the plan area. The next step was to determine whether the best available scientific information indicates a substantial concern for species persistence in the plan area. The following criteria were considered for these steps:

- A species with occurrences in a plan area that are merely “accidental” or “transient”, or are well outside the species’ existing range at the time of plan development, is not established or becoming established in the plan area (FSH 1909.12.52c).

- If the range of the species is changing so that what is becoming its "normal" range includes the plan area, an individual occurrence should not be considered transient or accidental. (FSH 1909.12.52c).
- If the species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats, trends in habitat, or response to management, that species cannot be identified as a species of conservation concern (FSH 1909.12.52c).
- Species that must be considered (FSH 1909.12.52d) include:
    - ♦ Species with NatureServe status ranks of G/T1 or G/T2 (see Table 5 below)
    - ♦ Species that were removed within the past 5 years from the Federal list of threatened or endangered species, and other species that the regulatory agency still monitors
- Species that should be considered (Ibid) include:
    - ♦ Species with NatureServe status ranks of G/T3, or S1 or S2 (see Table 5)
    - ♦ Species listed as threatened or endangered by relevant States or federally recognized tribes
    - ♦ Species identified by Federal, State, or federally recognized Tribes as high priority for conservation
    - ♦ Species identified as species of conservation concern in adjoining National Forest System plan areas (including those across regional boundaries)
        a. Species that have been petitioned for Federal listing and for which a positive "90-day finding" has been made.
        b. Species for which the best available scientific information indicates there is local conservation concern about the species' capability to persist over the long-term in the plan area due to: (1) significant threats, including climate change, (2) declining population trends in the plan area, (3) restricted range, and/or (4) low population numbers within the plan area.

Table 5. NatureServe conservation status ranks[1]

Status Rank	Status Rank Definition
1	*Species is Critically Imperiled* At very high risk of extinction or elimination due to very restricted range, very few populations or occurrences, very steep declines, very severe threats, or other factors.
2	*Species is Imperiled* At high risk of extinction or elimination due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.
3	*Species is Vulnerable* At moderate risk of extinction or elimination due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.
4	*Species is Apparently Secure* At fairly low risk of extinction or elimination due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.
5	*Species is Secure* At very low risk or extinction or elimination due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats.

[1] NatureServe conservation status ranks are based on a scale of 1 to 5, ranging from critically imperiled (G1) to demonstrably secure (G5). Status is assessed and documented at three distinct geographic scales: global (G), national (N), and State/province (S). The conservation status of a species or ecosystem is designated by a number from 1 to 5, preceded by a letter reflecting the appropriate geographic scale of the assessment (http://www.natureserve.org/explorer/ranking.htm). For more detailed information, go to: www.natureserve.org.

Scale

Species of conservation concern must be native to, and known to occur in, the plan area. The plan area is defined as National Forest System lands covered by a plan (36 CFR 219.19). For this assessment then, the plan area represents the primary scale for analysis, and includes all National Forest System lands within the Custer Gallatin National Forest administrative boundary. Because the directives state that a species is known to occur in the plan area if the species is established, or becoming established (emphasis added), non-National Forest System lands within the plan area boundary, as well as areas outside but adjacent to the Custer Gallatin National Forest boundary, were considered for species distribution and trends when evaluating potential species of conservation concern.

Existing Information

State wildlife management agencies for Montana (Montana Fish, Wildlife & Parks) and South Dakota (South Dakota Game, Fish and Parks) are the authorities for species-specific information. These agencies provided key information for the process of identifying potential species of conservation concern. The Natural Heritage Programs for the states of Montana and South Dakota were the primary information sources to determine species presence, abundance, distribution and trends in the plan area. The Natural Heritage Programs maintain extensive and detailed databases of species occurrences throughout their states, providing spatial and temporal data of all known wildlife occurrences. The Natural Heritage Programs, in coordination with the state wildlife management agencies for Montana and South Dakota, also set state conservation rankings for all native species (see Table 5 above for a description of ranks). The Montana State field guide (jointly maintained by Montana Natural Heritage Program and Montana Fish, Wildlife & Parks) is a repository of information regarding local and seasonal ranges used by native species, historic and current population trends, and also potential threats to species or their habitats. NatureServe is a non-profit organization that provides high-quality scientific expertise for conservation of species. Their website (www.natureserve.org) includes information on global, national and state rankings for species conservation (see Table 5 above) as well as information on population trends and threats where such information is exists. Local Forest Service information resulting from surveys and monitoring efforts also contains information on species presence, or lack of detections within the plan area.

The U.S. Fish and Wildlife Service (2008) identified birds of conservation concern by Bird Conservation Regions, or those geographic areas in which bird conservation efforts can be effectively planned and evaluated. The Custer Gallatin National Forest plan area falls within Bird Conservation Region 10–Northern Rockies, and Bird Conservation Region 17–Badlands and Prairies regions. Other information sources including the Forest Service Natural Resource Information System, the Northern Region Landbird Survey, Rocky Mountain Bird Observatory, and Breeding Bird Surveys contain information relevant to the plan area. However, most of the pertinent information in these databases is also incorporated in the Natural Heritage Programs databases. Local expertise is available from area biologists, scientists and land managers. Finally, published scientific literature is available for some species evaluated for potential species of conservation concern.

Existing Condition

The Custer Gallatin National Forest plan area is large and spread out across a very diverse landscape. It is located in two states, and adjacent to four other national forest administrative units: Beaverhead-Deerlodge, Helena-Lewis and Clark, Caribou-Targhee, and Shoshone National Forests). This configuration resulted in a large list of species evaluated for identification to the Regional Forester as potential species of conservation concern. See appendix A for a list of terrestrial wildlife species evaluated as potential species of conservation concern, including: global and state conservation ranks for each species; species occurrence, abundance and distribution within the plan area where known; and the reason each species was evaluated, as well as whether or not it is identified as a potential species of conservation concern. Table 6 contains this information for those species identified as potential species of conservation concern, followed by a detailed assessment for those species identified as potential species of conservation concern.

Table 6. Terrestrial wildlife species identified as potential species of conservation concern

Species Name	Conservation Ranking	Distribution in Plan Area	Rationale for Evaluating and Identifying as Potential SCC
Greater Sage-Grouse (*Centrocercus urophasianus)*	G3, MT S2, SD S2	Species occurs in sagebrush-dominated plant communities, primarily outside of plan area. Small numbers recently known to occur in the Pryor Mountains landscape. Historically present on the Ashland District. No known occurrence of this species on the Sioux District, however suitable habitat is present, but located near the District boundaries (see Figure 9).	Evaluated due to global and state rankings. This species is on the Regon 1 Sensitive Species list as suspected to occur on the Custer. Identified as potential species of conservation concern because of limited numbers of sage-grouse, and presence of core habitat in the plan area. Sage-grouse populations have been declining nationally and in the plan area, and the species was recently considered for Federal listing under the Endangered Species Act. Historic leks (breeding areas) within the plan area have not been verified as occupied for over a decade.
White-tailed Prairie Dog (*Cynomys leucurus*)	G4, MT S1, SD not ranked	Within the plan area, this species is only known to occur in the southwest corner of the Pryor Mountain landscape. Southern Carbon County (where the species occurs) is the extent of the species range in Montana, which is at the northern tip of the species range in the Western Hemisphere (NatureServe).	Evaluated due to state ranking in Montana, and sensitive on Shoshone National Forest. This species is on the Region 1 Sensitive Species list as known to occur on the Custer. Identified as potential species of conservation concern. Known to occur in only a very small, isolated portion of plan area within the Pryor Mountain landscape. This portion of the plan area plus surrounding BLM and private lands are the only areas where the species is known to occur in Montana. Montana State Wildlife Action Plan lists as “at high risk of extirpation” in the state. Small population vulnerable to disease (plague), and other factors; e.g. lethal control.

Species Identified as Potential Species of Conservation Concern

Greater Sage-Grouse

Introduction

Greater sage-grouse was petitioned for listing under the Endangered Species Act in 2010, at which time the U.S. Fish and Wildlife Service determined it to be “warranted but precluded” from listing. In 2015, after a review of the best available scientific and commercial information, the U.S. Fish and Wildlife Service determined that the greater sage-grouse did not warrant listing protections under the Endangered Species Act because the primary threats to populations had been ameliorated by conservation efforts implemented by Federal, State, and private land owners (USDI Fish and Wildlife Service 2015).

Process and Methods

Information on sage-grouse distribution within the plan area was obtained from the Montana and South Dakota Natural Heritage program databases, as well as consultations with state wildlife management agency personnel.

Scale

The Western Association of Fish and Wildlife Agencies identified sage-grouse management zones to facilitate conservation efforts (USDI Fish and Wildlife Service 2015). Management zones cover large landscapes that often cross state boundaries, and may include multiple Federal jurisdictions as well. The Custer Gallatin National Forest plan area is in the Rocky Mountain portion of sage-grouse range. The Ashland and Sioux landscapes are located in the Great Basin (management zone I), and the Pryor Mountain landscape is in the Wyoming Basin (management zone II). Total Forest Service landownership accounts for only 2 percent of each of these management zones (USDI Fish and Wildlife Service 2015), and the plan area accounts for only a small portion of the Forest Service ownership in each zone.

Current Plan Direction

The Custer Forest Plan stipulates that: Sagebrush control may only occur outside big game and sage-grouse winter range (page 23); constructed roads and facilities will not be within 200 feet of leks, nor will they separate leks from security cover or water (page 18); grazing systems will attempt to provide residual nesting cover for prairie grouse (page 18); and timing restrictions will prohibit all ground disturbing activity (including surface occupancy) within 0.25 mile of leks between 1 March and 15 April (page 19). In the monitoring requirements section of the Custer Forest Plan, requirement C9 stipulates that when less than 90 percent of dancing/booming grounds have an average stubble height of 12 inches remaining within a 1 mile radius further evaluation is required (page 106). The Gallatin Forest Plan does not contain direction or monitoring requirements for sage-grouse.

Existing Condition

Sage-grouse are known to occur in the plan area, and suitable habitat is present mainly in the Pryor Mountains, Ashland, and Sioux landscapes (see Figure 8 and Figure 9.) Much of the sage-grouse habitat in the plan area is located near the edges of Custer Gallatin National Forest administrative units, (i.e., an extension of suitable habitat from adjacent land of mixed ownership). Therefore, successful management of impacts to this species requires cooperation from all jurisdictions (e.g., Federal, state and private landowners) to achieve habitat conservation, restoration, and population management goals.

Distribution/Occurrence within the Plan Area

Sage-grouse observations are scattered across the Custer Gallatin National Forest, including just a few observations of transient or migratory individuals in the Madison, Gallatin, and Absaroka and Beartooth landscape, and no observations in the Bridger, Bangtail, and Crazy Mountain landscape. A small number of summering sage-grouse have been observed in the Pryor Mountain landscape. There are known active breeding areas near the Pryor Mountains, but they are all located entirely outside of the plan area. Most of the recorded observations are on the Ashland District. Only the Ashland and Sioux landscapes have direct or indirect evidence of breeding sage-grouse within the plan area (Montana Natural Heritage Program 2016).

Habitat Use and Distribution

Sage-grouse habitat is categorized as either core areas, or general habitat. Core areas provide habitat for 75 percent of all known breeding sage-grouse and represent landscapes of greatest biological importance to the long-term persistence of the species. The U.S. Fish and Wildlife Service referred to core areas as priority areas for conservation (Montana Natural Heritage Program 2016) and suggests that conservation efforts be targeted in these areas. Core (priority) areas are identified as those areas surrounding locations with the largest number of displaying males on leks (U.S. Fish and Wildlife Service

2013). Core areas identified within the plan area are located at the periphery of the Ashland and Sioux landscapes. Distribution of core habitat includes approximately 336 acres on the Ashland District and 1,868 acres combined on the Long Pines and Slim Buttes units of the Sioux District (see Figure 9).

There are three historic sage-grouse leks that were at least partially located within the plan area on Ashland District. Of these, Montana Fish, Wildlife & Parks records show five males present on one lek from 1980 to 81. This lek has since been monitored in 2000 and 2001, and again in 2014 and 2015 with no sage-grouse detected during these surveys. The other two leks were monitored in 1999 and 2000, but no grouse were observed on these leks during monitoring, and they have not been monitored since 2000 (DeVore, R., 2016, Montana Fish, Wildlife & Parks, personal communication). The status of all three leks on or near Ashland District remains unconfirmed, but there has been no sage-grouse breeding activity documented in recent years. The Long Pines Unit on the Sioux District contains a small amount of core habitat due to proximity of leks on adjacent land, but no record of breeding sage-grouse within the plan area in the Long Pines unit (DeVore, R., 2016, Montana Fish, Wildlife & Parks, personal communication). The portion of the plan area in South Dakota is all within Harding County, which is one of only two counties in South Dakota that still contain active sage-grouse leks. A small number of these leks are located near the boundary of the Slim Buttes unit on the Sioux District. However, the plan area contains a very small portion (0.14 percent) of the core habitat associated with sage-grouse leks in Harding County, South Dakota (South Dakota Game, Fish and Parks 2014).

General habitat is the area that provides sage-grouse habitat, but is not considered “core” habitat. General habitat is identified within the plan area, typically in lower elevation sagebrush dominated habitats rather than timbered portions of the plan area. General habitat is identified across the plan area, but varies in proportion by landscape area, starting at the Madison, Henrys, Gallatin and Absaroka and Beartooth Mountains landscape with approximately 2,776 acres, the Bridger, Bangtail, and Crazy Landscape with only 5 acres, the Pryor Mountains with 27,392 acres, Ashland District at 101,290 acres, and Sioux District with 8,424 acres. Recently, sage-grouse occurrence within the plan area has been limited to summer use of general habitat by one individual on Ashland District in 2014 (Montana Natural Heritage Program 2016) and five individuals monitored in the Pryor Mountain landscape from 2013 to 2015 (Pratt and Dillon 2015).

Figure 8 and Figure 9 show the distribution of core (priority) areas and general habitat for the Montane and Pine Savanna ecosystems.

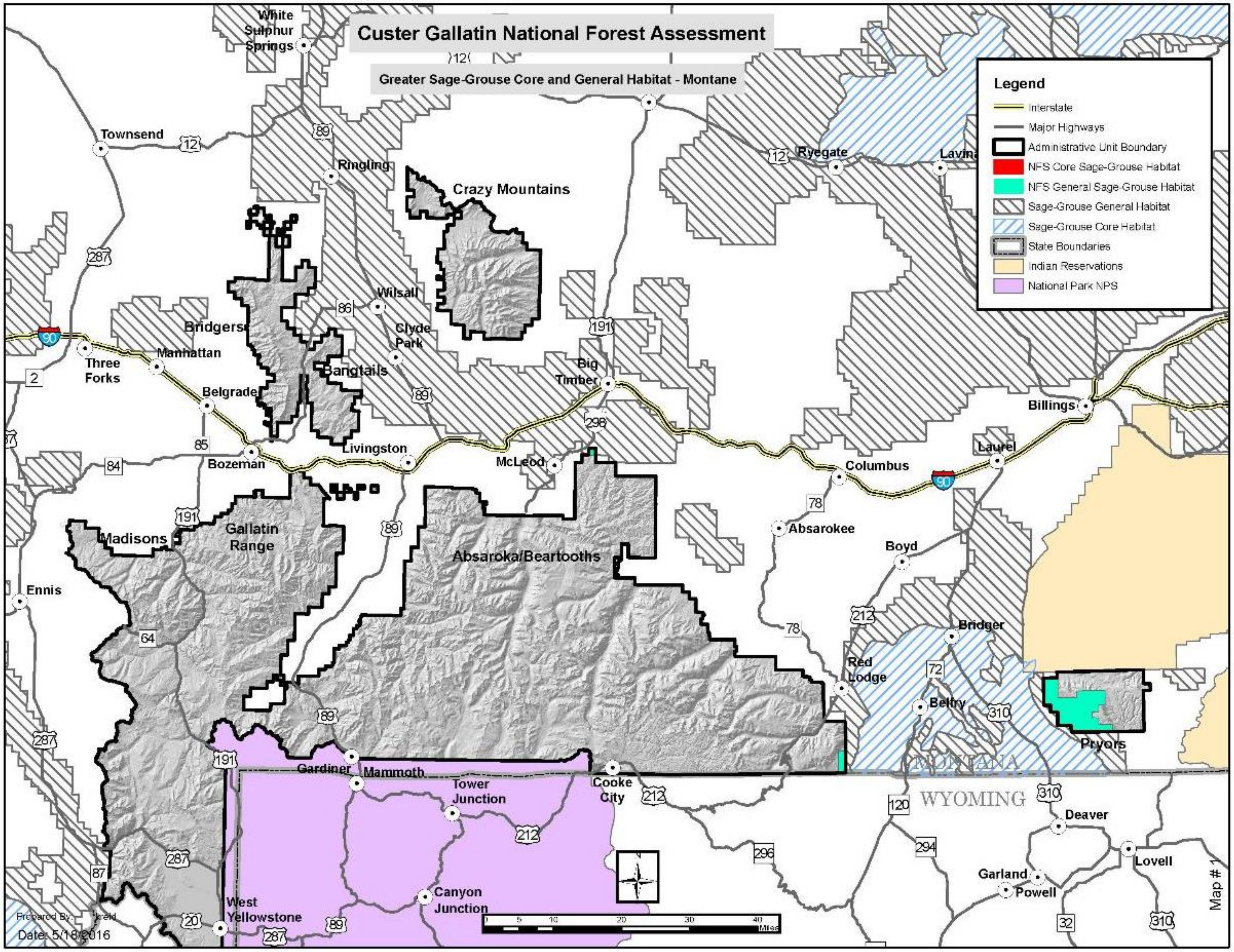

Figure 8. Greater sage-grouse core (red) and general habitat (cyan blue), Montane

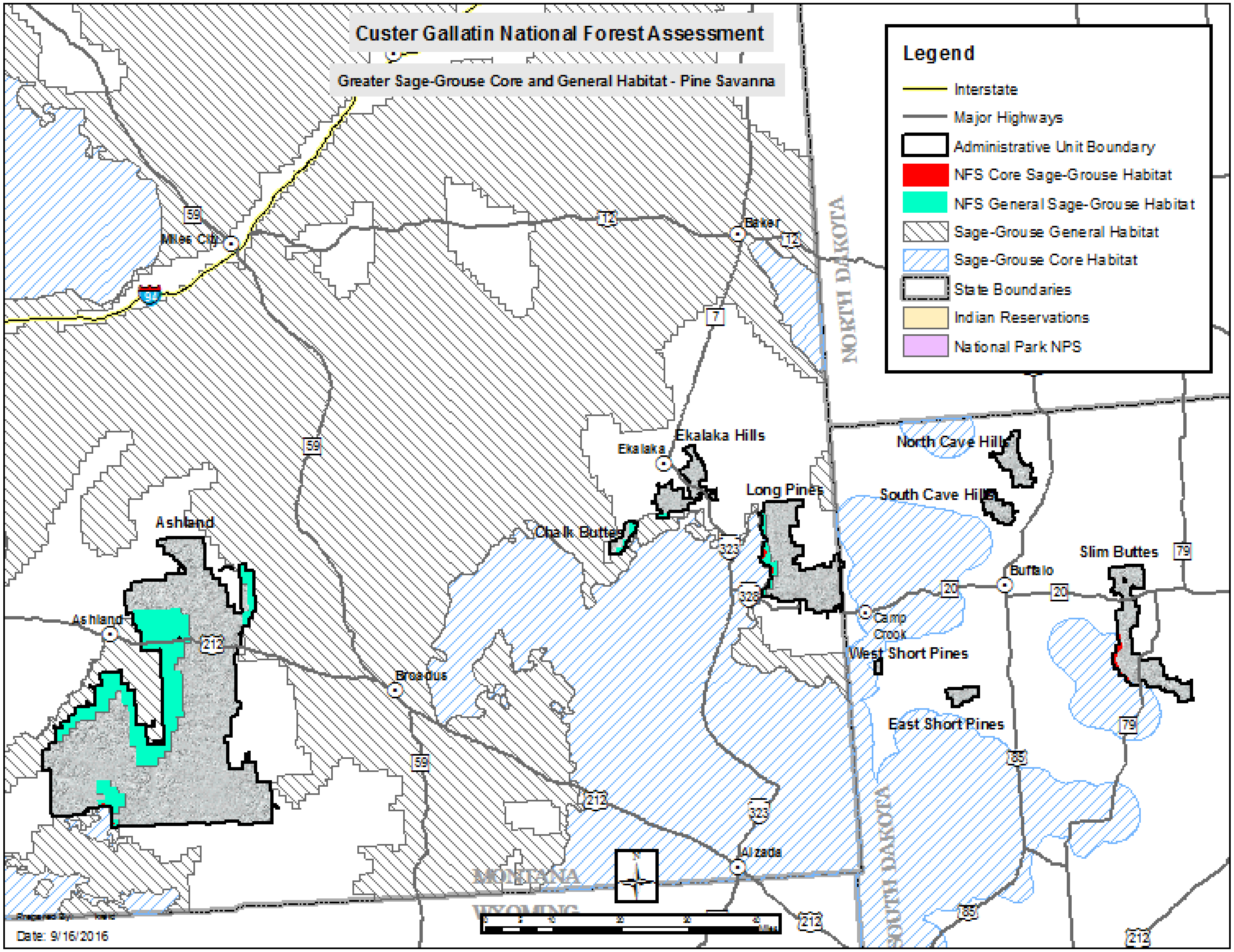

Figure 9. Greater sage-grouse core (red) and general habitat (cyan blue), Pine Savanna

Trends and Drivers

Before European settlement of North America (roughly before 1800), the greater sage-grouse occupied 13 United States, including both Montana and South Dakota (i.e., portions of the plan area), as well as three Canadian provinces. Historic sagebrush habitats potentially suitable for sage-grouse were estimated to cover approximately 460,000 square miles in North America prior to European settlement. Today, sage-grouse occupy approximately 56 percent of that historic range in 11 States (including Montana and South Dakota) and 2 Canadian provinces. Within the plan area, general and core (primary) sage-grouse habitat are typically found at lower elevations, along the administrative unit boundaries, and account for a small portion of the plan area land base (see Figure 8 and Figure 9 above). Perhaps because it is a minor component, occupied sage-grouse range has decreased only slightly within the plan area over time (USDI Fish and Wildlife Service 2015: page 59865).

Due to its extensive range, population cycles and other factors, estimating population trends for sage-grouse is difficult. Accordingly, population sizes are estimated from counts of male grouse on leks (breeding areas). Based on lek counts, there is evidence of range-wide population declines from data collected between 1965 and 2007. However, when more recent data were added (up through 2015), the population trend was still indicating a decline, but the rate of decline had actually decreased in management zones I and II (i.e., the management zones overlapping the Custer Gallatin National Forest plan area). Rangewide counts of male sage-grouse at leks increased in 2014 and 2015, and overall, population rates of decline have decreased since the turn of the 21st century (USDI Fish and Wildlife Service 2015).

State wildlife management agencies of Montana and South Dakota are charged with the management of greater sage-grouse within the plan area, and were consulted for data specific to the Custer Gallatin National Forest and surrounding areas. Montana Fish, Wildlife & Parks provided count data for 13 leks known to occur within 6 miles of the Ashland landscape boundary. Of these, none of the three historic leks at least partly within the plan area have been occupied within the past ten years. Of the remaining ten, all of which are entirely outside the plan area, only four have been active within the last 10 years, and the number of sage-grouse counted on these leks has generally declined since 2001 (Montana Fish, Wildlife & Parks 2016). There five sage-grouse leks near, but outside the plan area boundary in the Slim Buttes unit of the Sioux District in South Dakota. These leks have been active in recent years, but the number of sage-grouse observations have generally declined since 2007 (South Dakota Game, Fish and Parks 2014).

In 2012, a Conservation Objectives Team was established with representatives from each state within the range of the greater sage-grouse and U.S. Fish and Wildlife Service personnel. The following spring, the Conservation Objectives Team produced a final report, which identified threats to sage-grouse and provided recommendations for reducing threats or improving conditions for the species and its habitat (USDI Fish and Wildlife Service 2013). Threats to sage-grouse habitat identified in the Conservation Objectives Team report focused on loss and/or fragmentation of sagebrush habitats, due largely to human activities, but also from natural processes on the landscape. Human use can affect sage-grouse by physically altering habitat, which can result in permanent loss due to sagebrush conversion for agricultural, residential and/or commercial purposes. Human use can also cause functional loss of habitat due to disturbance from noise and human presence (USDI Fish and Wildlife Service 2013).

Fire, both natural and human caused, is a major factor associated with loss of sagebrush habitats and corresponding population declines for sage-grouse. Fire frequency and associated habitat loss has increased in the western portion of sage-grouse range in recent years, at least partly facilitated by the presence of non-native annual grasses such as cheatgrass and timothy. In addition to non-native grasses, other invasive plants (i.e., noxious weeds) have had impacts on sage-grouse habitat. Fire, improper grazing of domestic livestock and infrastructure associated with energy development are ground-disturbing factors that influence the spread of non-native plants, and therefore are also identified as potential threats to sage-grouse habitat. Furthermore, climate change has the potential to influence the spread and distribution of non-native plants over time. Conifer expansion into sagebrush communities can also affect quality and quantity of sage-grouse habitat. Conifer encroachment can result from changes in fire return intervals, which can in turn be influenced by fire suppression activities. Increased conifer presence may also be caused by overgrazing by domestic livestock. Climate change may facilitate conifer encroachment through increased carbon dioxide concentrations, but this theory has not been proven conclusively. Traditionally, fire and other vegetation management processes have been used to remove sagebrush in order to enhance grazing conditions for domestic livestock. Grazing pressure from domestic livestock, as well as impacts from wild ungulates and free-roaming horses have all been identified as potential threats to sage-grouse and their habitats. (USDI Fish and Wildlife Service 2013).

Within the plan area, roughly 88 percent of the general habitat, and all of the core (primary) habitat identified for sage-grouse is within grazing allotments for domestic livestock. Domestic livestock grazing has had impacts on sage-grouse habitat within the plan area. While some impacts continue, which will require monitoring and possibly management actions, generally speaking impacts to sage-grouse habitat from domestic livestock grazing on National Forest System lands in the plan area have been reduced in recent years. See the Non-forest Vegetation specialist report for more detailed information on this topic. Wild (feral) horses are present in the Pryor Mountains landscape, but do not overlap with sage-grouse habitat. Wild ungulates, primarily deer, but also pronghorn antelope and increasing numbers of elk, are present within portions of the plan area that contain sage-grouse habitat.

Other factors that can affect sage-grouse populations include disease, parasites, predation, and weather events such as severe spring storms or drought. These types of threats can vary in spatial and temporal impacts, but may be locally significant at the population and habitat level. An example of this type of local effect involved a West Nile virus outbreak in 2008 that had dramatic impacts a sage-grouse population in southwest North Dakota (USDI Fish and Wildlife Service 2013). This event occurred in close proximity to the easternmost part of the plan area (Sioux landscape), where both core (primary) and general sage-grouse habitat are located.

Information Needs

Greater sage-grouse have been widely studied and there is a large volume of scientific data available regarding this species and its habitat needs. A recent pulse of new science has been published on this species since 2010, when the U.S. Fish and Wildlife Service made an initial finding that the species was warranted for listing under the Endangered Species Act (USDI Fish and Wildlife Service 2015). Additional surveys and monitoring to determine whether any new sage-grouse leks are established, whether historic leks are recolonized within the plan area, and condition of core (primary) and general habitat would provide useful information for planning purposes.

Key Findings

Greater sage-grouse are known to occur within the plan area.

The plan area contains small amounts of core (primary) habitat as well as larger patches of general habitat for sage-grouse, but overall, the Custer Gallatin National Forest plan area is a very small contributor to sage-grouse habitat in the western United States (less than 0.1 percent).

Much of the sage-grouse habitat in the plan area is located near the edges of Custer Gallatin National Forest administrative units, (i.e., an extension of suitable habitat from adjacent land of mixed ownership). Therefore, successful management of impacts to this species requires cooperation from all jurisdictions (e.g., Federal, state and private landowners) to achieve habitat conservation, restoration, and population management goals.

Three historic leks are located at least partially on the Ashland landscape of the plan area. No breeding sage-grouse have been documented on any of these since the 1980s.

Sage-grouse habitat is located on the Custer portion of the Custer Gallatin National Forest. While there is useful direction for management of sage-grouse habitat in the existing Custer Plan, it is outdated, and there is relevant new science to consider.

This species is identified as a potential species of conservation concern on the Custer Gallatin National Forest due to limited distribution in the plan area, recent population declines and apparent lek abandonment in the plan area, as well as a variety of potential threats operating at various scales in the plan area and larger landscape. The Regional Forester will determine the final list of species of conservation concern.

White-tailed Prairie Dog

Introduction

Two species of prairie dog are found within the plan area, including the black-tailed prairie dog and the white-tailed prairie dog. There are similarities and differences between these species, both of which are used to provide context for this assessment. However, only the white-tailed prairie dog was found to meet the criteria for a potential species of conservation concern at this time. The black-tailed prairie dog was evaluated for inclusion as a potential species of conservation concern, but ultimately not identified for reasons found in appendix A. The white-tailed prairie dog (*Cynomus leucurus*) was petitioned for listing under the Endangered Species Act. In June 2010, the U.S. Fish and Wildlife Service issued a finding that the species was not warranted for listing. This determination was based on a rangewide assessment for the species. White-tailed prairie dog distribution in Montana is restricted to the south-central part of the state, including a small portion of the plan area in southern Carbon County. This limited distribution led the Montana Fish Wildlife and Parks department to identify the white-tailed prairie dog as a Species of Greatest Conservation Concern (Montana Fish, Wildlife & Parks [State Wildlife Action Plan] 2015).

Scale

In the continental United States, white-tailed prairie dogs occur as permanent residents in a four-state area, centered in Wyoming and extending into Utah, Colorado, and Montana. In Montana the species is at the northern edge of its range, occurring just north of the Wyoming border. The portion of the species' predicted range in Montana represents less than one percent of the total predicted range across the four-state area. The U.S. Fish and Wildlife Service estimated that only 2 percent of the predicted range for white-tailed prairie dogs in Montana is on National Forest System lands (USDI Fish and Wildlife Service 2010). The Custer Gallatin is the only National Forest administrative unit within the predicted range for white-tailed prairie dogs in Montana.

Current Plan Direction

There is no specific direction for white-tailed prairie dogs in either of the existing plans. However, the Custer Forest Plan addresses prairie dogs in general (i.e., including both black-tailed and white-tailed species). The current Custer Plan indicates that prairie dogs are to be managed in coordination with other resources, and that prairie dog control measures will be considered to address resource issues (pages 20–21). Before control programs may be approved, the agency must consider factors such as the presence of black-footed ferrets or other threatened/endangered species that could be negatively impacted, environmental implications of control methods proposed, and economic feasibility. Finally, the agency must consider whether the proposed control measures would maintain a suitable number of prairie dog towns to provide a reasonable gene pool and adequate distribution of colonies (page 21). The Custer Plan calls for monitoring of prairie dog management through surveys conducted every 3 years, with subsequent reporting every 3 years (page 106). An increase or decrease of 10 percent in the number of prairie dog towns, or a 10 percent increase in acres of prairie dog colonies within domestic livestock grazing allotments are indicated as the level of variation that would initiate further evaluation (i.e., consideration for control). Monitoring conducted for this plan requirement has mainly involved black-tailed prairie dog colonies, which are present in greater numbers than white-tailed colonies in the plan area. The Gallatin Forest Plan contains no direction or monitoring requirements for prairie dogs.

Existing Condition

Species Distribution/Occurrence within the Plan Area

Within the plan area, white-tailed prairie dogs are known to occur only in the very southeastern corner of the Madison, Gallatin, and Absaroka and Beartooth landscape. A single colony (estimated at roughly 40 acres in size in 2008) has been present in this area, located both within the plan area as well as on adjacent private land outside the plan area. This colony was active as of spring 2016. White-tailed prairie dogs are also found near the Pryor Mountain landscape of the plan area, but to date have been found entirely on BLM and private lands outside the plan area (Stewart, S., 2016, personal communication). The Bridger, Bangtail, Crazy, Ashland and Sioux landscapes are all outside the range of the white-tailed prairie dog. White-tailed prairie dogs do not occur in South Dakota.

Habitat Use and Distribution

In Montana, white-tailed prairie dogs are typically found in relatively dry habitats, within plant communities of mixed shrub and grass species. Their habitat is often dominated by Gardener's saltbush, and big sagebrush, interspersed with grass and forb species (Flath and Paulick 1979, cited in Montana Natural Heritage Program Field Guide 2016). White-tailed prairie dogs generally occur at higher elevations, and in habitats with more diverse plant cover than do black-tailed prairie dogs (Wilson and Ruff 1999, cited in Montana Natural Heritage Program 2016). In Montana, white-tailed prairie dogs are rarely known to disperse more than 200 meters (about 220 yards) from natal areas (Nistler 2009). Therefore, while there may be suitable habitat present within and between landscapes in the plan area, there is low probability that much additional habitat would be naturally colonized by white-tailed prairie dogs in the near future. White-tailed prairie dogs that currently occupy National Forest System lands within the plan area are there as a result of a translocation project conducted by Montana Fish Wildlife and Parks early in the 21st century. This effort was intended to re-establish white-tailed prairie dogs in areas where they had previously been extirpated (Montana Fish, Wildlife & Parks [State Wildlife Action Plan] 2015).

Trends and Drivers

There are no records of white-tailed prairie dog occurrence in Montana prior to European settlement (Montana Prairie Dog Working Group 2002), and no reliable long-term population trend data for the species (USDI Fish and Wildlife Service 2010). However, the area occupied by the species has declined considerably in recent years. The historic range of white-tailed prairie dogs in Montana appears limited to the shrub/grassland habitats located in the valleys between the Beartooth and Pryor Mountain Ranges, but there are some early occurrence records for the species from areas north of the current distribution (USDI Fish and Wildlife Service 2010). During the 1970s, Montana had 15 known colonies, covering approximately 700 acres in Carbon County. By 1997, only two of those colonies remained occupied, in areas covering only about 97 acres. In 2009, Montana reported eight active colonies covering a total of roughly 280 acers (Montana Prairie Dog Working Group 2002; USDI Fish and Wildlife Service 2010). The single colony known to be active within the plan area was first reported in 1976, and was shown to be decreasing by 1998. In 2008, the reported extent of this colony was 40 acres in size (Montana Natural Heritage Program 2016), located both on National Forest System land within the plan and adjacent private land outside the plan area. The colony was active as of spring 2016; however, most likely due to recent residential development on the private portion of the site, the colony was found to be active primarily on National Forest System lands within the plan area (Stewart, S., 2016, personal communication).

The major factors responsible for white-tailed prairie dog range contraction in Montana are thought to be plague and permanent habitat conversion for human uses (Montana Prairie Dog Working Group 2002; USDI Fish and Wildlife Service 2010). Permanent habitat conversion within the range of the white-tailed prairie dog has been a minor factor on National Forest System lands. Prairie dogs live in colonies and are highly social, which makes them more likely to transmit disease than less social species. However, of the prairie dog species that occur in the plan area, white-tailed prairie dogs naturally occur at lower densities, and do not often engage in social activities such as grooming each other, so they tend to be less susceptible to plague transmission than are their black-tailed relatives (Nistler 2009). Nevertheless, plague is a major driver of white-tailed prairie dog populations.

Plague is not endemic to North America, and sylvatic plague is a relatively recent occurrence in prairie dog populations. It was first reported in white-tailed prairie dogs in Wyoming in the 1930s (Nistler 2009), but was not documented as impacting populations in Montana until the late 1980s or early 1990s (Montana Prairie Dog Working Group 2002). For reasons listed above, plague transmission is relatively slow in white-tailed prairie dog populations (compared to black-tailed), and there are usually enough survivors to maintain a host population for the fleas that carry the disease, thus perpetuating a cycle of localized reductions or extinctions of individual colonies, often followed by expansions or recolonization of areas when disease levels are low (Nistler 2009).

Other factors that may impact prairie dog habitat include oil and gas exploration and development, mineral development, wind and solar energy development (USDI Fish and Wildlife Service 2010). There are currently no active operations of these sorts occurring within the plan area occupied by white-tailed prairie dogs. Given economic indicators, little expansion of such activities is reasonably expected within the range of the species in the near future (see Minerals specialist report for detailed information). The U.S. Fish and Wildlife Service found none of these activities to be a significant threat to the white-tailed prairie dog (USDI Fish and Wildlife Service 2010).

Grazing by both native and domestic animals can impact prairie dog habitat. Prairie dogs coevolved with native herbivores such as pronghorn antelope, bison and mule deer. Domestic livestock were introduced in the late 1800s, and impacts from overgrazing by domestic livestock coupled with severe droughts in the early 20th century had major impacts on sagebrush habitats. Grazing practices have since been refined, and the intensity of domestic livestock grazing has decreased since the early 1900s (USDI Fish and Wildlife Service 2010). Within the plan area, domestic livestock grazing has declined as well, including the portion within the range of the white-tailed prairie dog (see the Range Specialist Report). There is evidence that white-tailed prairie dogs can coexist with managed livestock grazing and may even benefit from some level of livestock use (USDI Fish and Wildlife Service 2010). However, there are no domestic livestock grazing allotments within the plan area currently occupied by white-tailed prairie dogs (see the Range specialist report).

Fire occurrence and suppression are additional factors that may affect prairie dog habitat. Shrub-steppe habitat favored by white-tailed prairie dogs evolved with fire as a natural disturbance process that occurred at relatively low frequency intervals. Fire frequency intervals in lower elevation sagebrush habitats have increased since European settlement, largely due to the presence of non-native plants such as cheatgrass. Intense fire can kill sagebrush, and often favors invasive species. White-tailed prairie dogs use shrubs as forage, as well as escape cover from predators, and severe reductions in shrub cover may have negative impacts on habitat. However, prairie dogs also forage on grasses and forbs, which may increase as a result of fire (USDI Fish and Wildlife Service 2010). Fire suppression can result in an increase in tree and shrub species in sage-steppe habitats, at the expense of native grass and forb species that provide important forage components for prairie dogs. In recent years, neither fire occurrence nor fire suppression has been a major habitat driver in the portion of the plan area occupied by white-tailed prairie dogs.

Invasive plant species such as non-native annual grasses and a variety of noxious weeds, are introduced by humans, and propagated by major ground-disturbing activities and processes. Invasive plant species often out-compete, and may eventually replace native species. Invasive species can alter the environment in ways that may increase habitat vulnerability to more invaders, or increase susceptibility to natural processes such as the cheatgrass-fire relationship described above. Invasive species can be especially harmful in the drier environments used by white-tailed prairie dogs, because invasive plants often have deeper root systems, which can affect soil moisture and deprive native plant species of needed water and nutrients (USDI Fish and Wildlife Service 2010). Invasive plant species are a widespread resource issue within the plan area and infested acreage has increased notably in recent years, including the general area occupied by white-tailed prairie dogs (see Invasive Plants specialist report). The U.S. Fish and Wildlife Service found that some level of invasive species infestation is likely tolerated by white-tailed prairie dogs and there is no evidence that invasive plants are a significant threat to the species at this time (USDI Fish and Wildlife Service 2010).

Shooting of prairie dogs has been used historically for population control, and is still a popular sport in some areas (USDI Fish and Wildlife Service 2010). Hunting of wildlife species falls under jurisdiction of the state. Both black-tailed and white-tailed prairie dogs are identified as species of concern by the state of Montana. For regulatory purposes, both species have dual designation of “nongame” status by the Montana Fish, Wildlife & Parks, as well as “vertebrate pests” by the Montana Department of Agriculture. As such, recreational shooting of prairie dogs is largely unregulated (Montana Fish, Wildlife & Parks 2007; Nistler 2009). Effects of recreational shooting have not been well-studied for white-tailed prairie dogs (USDI Fish and Wildlife Service 2010). However, studies on black-tailed prairie dogs showed that recreational shooting directly reduces effective population size of prairie dog towns, which may compromise their ability to expand and disperse to surrounding towns or establish new colonies. Recreational shooting has indirect effects of increasing flea loads on surviving prairie dogs, which can increase the likelihood of plague infection. Also of note is the secondary effect of lead poisoning of species that scavenge prairie dog carcasses (Montana Prairie Dog Working Group 2002; Nistler 2009;

Hanauska-Brown, L., 2016, personal communication). White-tailed prairie dogs are susceptible to the same unrestricted recreational shooting as black-tailed prairie dogs. However, the lower population density and less social structure of white-tailed prairie dog colonies may discourage recreational shooters from targeting them as intensely as black-tailed prairie dog colonies (USDI Fish and Wildlife Service 2010). Montana Fish, Wildlife & Parks prohibited shooting of white-tailed prairie dogs on public lands from 2006 to 2008 (Montana Fish, Wildlife & Parks 2007). Currently, there are no regulations restricting shooting of nongame species in Montana (http://fwp.mt.gov/hunting/regulations/nongame).

Poisoning is another mechanism historically applied to control prairie dog populations. Due to the species' state designation as "vertebrate pests", the Montana Department of Agriculture advises landowners how to effectively control prairie dog populations with poison, however the agency does not advocate control of prairie dogs. This form of prairie dog control is within Forest Service administrative jurisdiction on National Forest System lands within the plan area. Poisoning of prairie dogs on National Forest System lands requires a special use permit, and requisite NEPA analysis. No permits have been issued for the poisoning of white-tailed prairie dogs on National Forest System lands within the plan area since the original (1986) Custer Plan was implemented (USDA 2000).

Finally, climate change has been identified as a factor that could potentially affect white-tailed prairie dogs. There is substantial evidence that globally, climates are changing, and generally, temperatures are increasing in the Great Plains region that includes the range of white-tailed prairie dog in Montana and Wyoming. Temperatures are predicted to continue to rise over time in western states, with possible increases in fire size, severity and frequency. Such changes may affect availability of suitable habitat, and could potentially result in a range shift for white-tailed prairie dogs. Climate change is also expected to affect precipitation, potentially increasing precipitation levels in the Great Plains region, which could benefit white-tailed prairie dogs. Plague ecology could also be influenced by climate change, but impacts are difficult to predict since plague transmission is positively correlated with rainfall, but negatively correlated with total number of hot days and overall temperature increases. Warmer winter temperatures could affect plague transmission through reduced periods of prairie dog hibernation and better over-winter survival of plague-carrying fleas (USDI Fish and Wildlife Service 2010).

Information Needs

In 2009, Montana Fish, Wildlife & Parks sponsored a review of prairie dog demographics in Montana (Nistler 2009). One outcome of this effort was the identification of information gaps regarding the species' ecology and implications for management. Following are excerpts from Nistler (2009):

Habitat manipulation can be used to aid the conservation of prairie dogs. Additional information is needed to determine how resulting landscape changes, and methods used, affect the surrounding prairie ecosystem.

More research is needed on survival, reproduction and dispersal characteristics of white-tailed prairie dogs to better understand whether, and how such parameters might be managed for prairie dog conservation.

More information is needed on the mechanisms driving plague infestations at both local and landscape scales.

A better understanding is needed of the impacts of recreational shooting on prairie dog genetic diversity, survivability, direct impacts on habitat and indirect impacts on associated species.

Key Findings

White-tailed prairie dogs are known to occur within the plan area. Currently only one colony is known to be active on National Forest System lands within the plan area.

Current and historic occupancy of the species on National Forest System lands occurs at a very small scale, such that the Custer Gallatin National Forest plan area is a very small (roughly 0.02 percent), but important, contributor to white-tailed prairie dog habitat in the western United States.

Primary threats to the species include impacts from disease (e.g., plague) and permanent conversion of habitat for human use (e.g., agriculture). The Forest Service has little control over the presence, distribution, and/or spread of plague, and no control over permanent conversion of lands other than National Forest System lands. However, permanent conversion of habitat on National Forest System lands is unlikely, and largely within agency control. Secondary threats such as impacts from prescribed burning, fire suppression, invasive plants and domestic livestock grazing pressure can be managed by the agency.

This species is identified as a potential species of conservation concern on the Custer Gallatin National Forest due to limited distribution in the plan area, recent population declines and reduction in colony size, as well as a variety of potential threats operating at various scales in the plan area, and across the larger landscape. The Regional Forester determines the final list of species of conservation concern.

Species of Public Interest

Introduction

This section of the assessment deals with terrestrial wildlife species that are commonly enjoyed and used by the public for hunting, trapping, observing or sustenance, including cultural or tribal uses. Some of these species are addressed under previous headings in this section. For example, grizzly bears are a large draw for tourism in the Greater Yellowstone Ecosystem, including parts of the plan area. People come here with the goal of safely observing grizzly bears in their natural habitat. Wolverines are classified as a furbearer in Montana, and have been harvested by trapping historically, although the trapping season for wolverines is currently effectively closed. These two species were addressed as at-risk species, federally listed as threatened (grizzly bear), and proposed for federal listing (wolverine above), so will not be further evaluated here. The Custer Gallatin is rich with wildlife resources, with a number of species that cannot be easily found in other parts of the country. This factor makes wildlife viewing a high priority for many people who live, work and/recreate within or near the project area. Wildlife viewing has relatively low impacts on wildlife and their habitat. Due to the large number terrestrial wildlife species attractive for viewing, individual species habitat concerns will not be addressed here. Hunting of terrestrial wildlife species accounts for a large proportion of recreational uses in many parts of the plan area. This section of the assessment will focus on species of interest for hunting, sustenance, and cultural/tribal uses.

Big Game Species: Ungulates

Introduction

In this section, major big game species that are hunted are considered. While there is a large body of data and literature for elk, we also address mule deer, white-tailed deer, moose, bighorn sheep, bison, and mountain goats. These species are managed by Montana Fish, Wildlife & Parks in Montana, and South Dakota Game Fish and Parks. Deer and elk and are widely distributed throughout the plan area, and occur in each of the landscape areas. Moose occur mostly in the Montane landscapes, but are occasionally observed on the Ashland and Sioux Districts. Bighorn Sheep and Mountain Goats are found exclusively in the Montane Ecosystem landscapes. Mountain goats are not native east of the Continental Divide. The populations on the Custer Gallatin National Forest are the result of transplants dating back to the 1940s. Montana released a conservation strategy for bighorn sheep in 2010, which provides recommendations on habitat management and monitoring, as well as individual population management plans. Bison only occur seasonally on the Gallatin side of the Forest near Gardiner and West Yellowstone when they exit Yellowstone National Park in search of winter forage in various numbers depending on winter severity. Bison are governed by an Interagency Bison Management Plan, which is currently being revised by the National Park Services and Montana Fish, Wildlife & Parks. Other agencies, including the Custer Gallatin National Forest, are collaborators but not signatory to the new record of decision, which is planned for release in 2017. The purpose of the new plan is to conserve a wild and migratory population of Yellowstone area bison, while minimizing the risk of brucellosis transmission between bison and livestock to the extent practicable.

Process and Methods

Montana and South Dakota provided survey and trend information. In addition, state plans were consulted for pertinent information about State goals and objectives. Montana's Elk Plan dates to 2004. South Dakota's Elk Plan is in draft form and does not include information about the Sioux Ranger District, where elk are transient and there is no hunting season. Aerial surveys/trend counts trend counts are usually conducted by aerial survey, either by helicopter or fixed-wing aircraft, although in some areas counts may be conducted from the ground. Most big game flights are conducted on relatively open winter ranges (Montana Fish, Wildlife & Parks 2004).

Scale

In Montana, the State Elk Plan considers elk management units, which are groupings of hunting districts. For habitat assessments, the Forest Service and Montana Fish, Wildlife & Parks have collaborated in identifying elk analysis units, which represent a yearlong home range use area for a specific elk population. For other big game species, there are distinct herds (bighorn sheep) and/or hunting districts. Bison from two different herds use the Custer Gallatin National Forest; one herd migrates out of Yellowstone National Park to the north along the Yellowstone River, and the other to the west along the Madison River.

Existing Information

The best information about big game species in the plan area comes from state surveys and documents, including state management plans and conservation strategies. Pertinent literature was also reviewed.

There has been more interaction and collaboration between the state wildlife management agencies and the Custer Gallatin National Forest relative to elk than for most species; although the two agencies have worked together in conjunction with Montana State University on some bighorn sheep and mountain goat efforts. In addition, there has been funding from the Custer Gallatin National Forest for Montana Fish, Wildlife & Parks to conduct moose monitoring on the Hebgen Lake Ranger District. For bison, the Yellowstone National Park bison biologist was interviewed, and literature provided by the Buffalo Field Campaign was reviewed. A recently published book (White et al. 2015), which provides a complete overview of Yellowstone bison, was the basis for much of the data and information for bison. In addition, data from an on-going vegetation study in the Gardiner Basin by Montana State University was used to inform the discussion on bison habitat.

In 2013, a group of wildlife biologists from the Forest Service and Montana Fish, Wildlife & Parks compiled recommendations, along with a discussion of their conversations and the relevant literature, for elk habitat management. The recommendations apply only on the Custer Gallatin and Helena-Lewis and Clark National Forests (Montana Fish, Wildlife & Parks and USDA Forest Service 2013). The recommendations resulting from these efforts were based on the most current available information in the literature, and the collective experiences of these biologists. They considered contemporary issues and circumstances such as increases in recreation of all types on these National Forests, changes in the numbers and distribution of elk (including elk use of private lands where hunting is limited or not allowed), the restoration of large predators, the current mountain pine beetle epidemic, and small and large fires on these two national forests.

Following the collaborative effort, the Forest Service provided an "Elk Analysis Framework" for the purpose of providing a menu of analytical methods and habitat models to address the potential effects of proposed Forest Service project activities on elk habitat. This framework was prepared in response to: (a) a desire to narrow the varied interpretations of available information regarding elk; (b) improve the consistency on how potential effects are assessed among the above-mentioned national forests; (c) and provide a clear understanding of potential effects to better collaborate with Montana Fish, Wildlife & Parks in providing for elk and elk habitat. Several habitat models were developed in concert with the Northern Region geospatial analysts. The models summarize existing conditions for cover, habitat effectiveness (motorized route density), and security areas during the big game hunting season. In 2015, Montana Fish, Wildlife & Parks and the Custer Gallatin National Forest collaborated with Montana State University to beta test the Framework recommendations using GPS elk collar data from nine study areas. The results of these contemporary analyses and resource selection models for elk summer and fall habitats are summarized below.

Current Forest Plan Direction

Existing Forest Plans for both the Custer and Gallatin contain considerable information and direction for management of big game habitat. Topics covered include protection of winter ranges and calving areas, providing hiding cover and security areas, maintaining habitat structural diversity, providing forage needs, and minimizing impacts from land use activities such as vegetation management. Travel management plans for both forests contain direction for controlling human access, both to facilitate hunting opportunities, as well as to manage impacts to big game species and habitats.

Existing Condition

Elk

Populations

Elk numbers have been increasing in many parts of Montana since the early to mid-1900s (Montana Fish, Wildlife & Parks 2004). Elk are managed and counted, however, by elk hunting districts or elk management units for which population and habitat objectives have been set (Montana Fish, Wildlife & Parks 2004; Cunningham 2014; Montana Fish, Wildlife & Parks 2015). The most recent elk counts, as well as information regarding whether the unit is at, above, or below the objective established in the statewide plan is displayed in Table 7.

Table 7. Estimated elk population and trend by landscape area

Landscape	Elk Management Unit	Hunting District(s)	Elk Plan Objective (Observed Elk)	2014 or Most Recent Number Elk Observed	Status: Over, At or Below Objective and Trend	Estimated Actual Elk Numbers[1]	Hunter Opportunities(2016 Regulations)
Bridger, Bangtail, and Crazy Mountains	Bridger[2]	312, 390, 391, and 393	2,840–4,260	9,236	Over objective	11,545	Brow-tined bull or antlerless plus unlimited cow permits on private land
Bridger, Bangtail, and Crazy Mountains	Crazy Mountain	315 580	800–1,200 780–1170	1,246 4,616	Over objective	1,558 5,770	Brow-tined bull or antlerless plus 400 cow permits; either sex permits on private land
Madison, Henrys, Gallatin and Absaroka Beartooth Mountains	Gallatin Madison	301, 309 Lower Gallatin; Bozeman Face	400–600	587	At objective; stable	734	301: Brow-tined bull or antlerless plus cow permits on private lands only. 309: either sex archery and rifle; cow harvest late season on private lands
Madison, Henrys, Gallatin and Absaroka Beartooth Mountains	Gallatin Madison	310 Upper Gallatin Canyon	1,200–1,800	372	Below objective; increasing	465	Youth season for brow-tined bulls; permits for brow-tined bulls; one per hunter
Madison, Henrys, Gallatin and Absaroka Beartooth Mountains	Gallatin Madison	311 Spanish Peaks	2,000–3,000	1,052 (Flying D only; does not reflect objective)	At objective; stable	1,315	Either sex youth hunt; brow-tined or antlerless
Madison, Henrys, Gallatin and Absaroka Beartooth Mountains	Gallatin Madison	314 West Paradise Valley	2,400–3,600	3,528	At objective	4,410	Brow-tined bull or antlerless plus 25 cow permits
Madison, Henrys, Gallatin and Absaroka Beartooth Mountains	Gallatin Madison	360,361,362 East Madison Valley	4,260–5,140	5,694	Slightly over; stable to increasing	7,118	Brow-tined bull or antlerless archery; brow-tined rifle; youth either sex; 500 cow permits
Madison, Henrys, Gallatin and Absaroka	Northern Yellowstone	313, 316 Gardiner Basin	3,000–5,000	3,758	At objective outside of the park. There has	4,698	313: 30 cow permits for youth and by draw (holders may not hunt antlered elk)

Landscape	Elk Management Unit	Hunting District(s)	Elk Plan Objective (Observed Elk)	2014 or Most Recent Number Elk Observed	Status: Over, At or Below Objective and Trend	Estimated Actual Elk Numbers[1]	Hunter Opportunities(2016 Regulations)
Beartooth Mountains		North of Yellowstone Park			been a dramatic decline in the elk population on the Yellowstone Northern Range		50 brow-tined bull permits first choice only September 3–October 16 and November 14–Nov 27 316: backcountry hunt; either sex September 15–October 21 antlered bull Oct 22–November 27 (either sex youth)
Madison, Henrys, Gallatin and Absaroka Beartooth Mountains	Absaroka	520, 560 Beartooth District, Boulder River	2,420–3,180	4,374	Over objective	5,468	Antlerless archery and either sex rifle; 1,200 cow permits on private land plus early and late season hunts on private land
Ashland and Sioux	Custer National Forest	704 (Ashland) 705 (Sioux)	400–600	1,028 415	Over objective; discussion about changing to 1,000	1,804	Antlerless archery; antlerless rifle on private lands; 225 either sex permits rifle; 500 cow permits not valid on National Forest System lands

[1] Estimated numbers assume 80 percent of elk are observed (http://fwp.mt.gov/fishAndWildlife/management/elk/).

[2] Only Hunter District 312 and 393 are in the plan area, and both are over objective.

Note: Data from Montana Fish, Wildlife & Parks (there are no resident elk on the South Dakota side of the Sioux District). (http://fwp.mt.gov/fishAndWildlife/management/elk/)

Generally, elk populations have increased since the current Forest Plans were signed. In addition, Montana Fish, Wildlife & Parks developed an elk plan and set objectives based on habitat and landowner tolerances (updated in 2004). Many of the elk herds on the Custer Gallatin are within the objectives set by Montana Fish, Wildlife & Parks. There are two situations where elk populations are dramatically lower than in the past. These include the Upper Gallatin elk (Hunter District 310), where historically there were concerns about elk being over carrying capacity. Since 2005, elk have been declining and a part of the elk herd leave the Gallatin Valley and occupy private lands in the Madison Valley during the winter (or earlier) (Cunningham 2014). Similarly on the Northern Yellowstone Range (Hunter District 313), historic elk wintering populations were very high due to high numbers of elk summering in Yellowstone National Park. Elk populations were managed in part through the Gardiner "late hunt" giving hunters an opportunity to harvest elk as they migrated out of Yellowstone National Park. The overall population has dropped from over 20,000 to fewer than 5,000 elk. However, the number of elk wintering outside Yellowstone National Park in Montana has remained relatively stable for most of the last 10 years (Cunningham 2014). The proportion of elk leaving Yellowstone National Park during the winter has increased from about 50 percent to over 70 percent. Causes for this population decline may include overharvest by hunters, predation by wolves, and competition with a growing bison population on the northern range.

Other elk populations on the Custer Gallatin National Forest are dramatically over objective. These situations are generally a result of limited hunter access to or through private lands (e.g., Hunter Districts 580 and 393). One exception to this is on the Ashland Ranger District. Elk have pioneered this unit of public land and rapidly spread and increased in numbers. There is some support for changing the objective to 1,000 animals in recognition of this population growth since there is good public hunting opportunity and harvest levels to keep the herd at this target are likely achievable (Waltee 2013). Forage for elk was likely one reason for the increase, as Ashland has had a variety of both prescribed and wild fires, with the largest occurring in 2012. Similarly, due to the Derby Fire of 2006, elk have pioneered that area of the Yellowstone Ranger District and have steadily increased.

Montana Fish, Wildlife & Parks elk population management focuses on maintaining numbers above population viability thresholds, protecting certain sex and age classes from over-harvest, providing public hunting opportunity, and attempting to balance elk distribution across public and private lands. This is reflected by the hunter opportunities shown in Table 7. The Forest Service strives to complement Montana Fish, Wildlife & Parks' efforts through management of elk habitat on Forest Service lands (Montana Fish, Wildlife & Parks and USFS 2013). As such, both agencies share the management goal of maintaining elk on public lands and work together to design habitat management recommendations to achieve this goal.

Habitat

Cover. Elk are habitat generalists, foraging on a wide variety of grasses, forbs, and occasionally on shrubs or other browse. They typically summer in higher elevation areas, often on National Forest System lands, where both forage and cover are available. Winter habitat usually occurs at lower elevations and most often below the elevation of the National Forest on private lands. Small groups of elk may remain over winter at higher elevation where slopes consistently blow free of snow. Use of specific areas and habitats may change over time due to a variety of factors that may include changes in vegetation, patterns of human use, transportation systems, weather and climate patterns, changes in the behavior of individuals and groups of elk, hunting pressure and natural predation.

Just prior to the first Forest Planning efforts, forest management focused primarily on timber production. As a result, an extensive transportation system was developed to support silviculture and harvest operations. The cooperative elk-logging studies of the 1970s and 1980s provided some of the first insights into the effects of these activities on habitat use by elk, and developed the concept of managing public lands to include secure areas for elk (Lyon et al. 1985). While specific recommendations were not made, it was recognized that logging activity and the associated roads caused displacement of elk from areas of traditional use. Thus, it was recommended that timber harvests should be designed to minimize the number of routes and the duration of logging activity (Lyon et al. 1985). This body of information was originally incorporated into many Forest Plans, including the Gallatin Forest Plan. The main standard for elk in the current Gallatin Forest Plan is 6a (5), which requires retention of two-thirds of the hiding cover over time. This standard was worded differently in the original forest plan and required a white paper for its interpretation (Canfield 2011) and therefore was clarified in an amendment completed in 2015.

A current snapshot of cover by analysis area is found below. Hiding cover is defined as all Douglas-fir, lodgepole pine, and subalpine fir cover types having at least 40 percent canopy cover for the Montane areas, and ponderosa pine cover greater than 40 percent canopy cover for the Ashland and Sioux areas. Affected hiding cover is defined as those areas with the potential to be hiding cover, but because of recent (15 years) disturbances, are currently not functioning as hiding cover. Other cover is defined as those forest types mentioned above at canopy cover levels less than 40 percent. Forty percent is used as a proxy based on field studies completed on both the Gallatin and Custer sides of the forest (Canfield 2011; Canfield 2012).

Table 8. Characterization of hiding cover in the planning area

Landscape	Hiding Cover	Affected Hiding Cover	Other Forest Cover	Not potential hiding Cover
Madison, Henrys, Gallatin and Absaroka Beartooth Mountains	38%	7%	23%	32%
Bridger, Bangtail, and Crazy Mountains	52%	1%	17%	30%
Pryor Mountains	0%	3%	61%	36%
Ashland District	11%	19%	17%	53%
Sioux District	10%	21%	10%	59%

The values in Table 8 demonstrate that the Montane Ecosystem landscapes have mostly functional hiding cover and less open canopy forest, whereas the pine-savanna landscapes have inherently higher disturbance occurrences and inherently less dense canopy cover.

Fall Habitat. In the early 1990s, biologists from both agencies recognized that a new management paradigm was needed, leading to the Elk Vulnerability Symposium in Bozeman, Montana in April 1991, hosted by the Montana Chapter of the Wildlife Society. It was here that the concept of security areas for elk was first formalized (Hillis et al. 1991). Hillis et al. (1991) analyzed data collected from radio-collared elk (bulls and cows) during the rifle hunting season in relatively continuous conifer forests in western Montana (Lyon and Canfield 1991) They recommended managing for at least 30 percent of a valid analysis area in forest blocks of similar canopy cover structure, which were at least 250 acres in size, and at least 0.5 mile from the nearest motorized route. The objective of managing for security areas was to provide reasonable levels of bull elk survival and hunter opportunity during the rifle hunting season. The authors cautioned that the numerical parameters they reported for block size and distance to the nearest motorized route should not be considered an exact ‘recipe’ to be followed in all situations, but that the concepts (size, distance, and percent of a valid analysis area) could be tailored to an area based on local knowledge. As such, a variety of security definitions, some including specific requirements for minimum forest cover, have been used in developing travel management plans and for evaluating project level effects on elk (Christensen et al. 1993). In areas where forest cover is less contiguous than western Montana, where the Hillis paradigm was generated, the importance of forest cover for security areas has been questioned, but not formally examined.

More recently, a group of Forest Service and Montana Fish, Wildlife & Parks biologists recently summarized and evaluated literature and discussed their own experiences in managing elk populations and habitats across southwest Montana and developed collaborative recommendations that included the need to manage travel routes and closures to include the archery season; the need to provide hunting season security through tailoring the concepts from Hillis et al. to specific situations and security area needs; the need to manage summer range for low motorized route densities (habitat effectiveness); the need to provide forest cover within the historic range of variability; acknowledgement that there is no need to distinguish between hiding and thermal cover (and agreeing on a proxy of 40 percent canopy cover); the need to minimize disturbance of all types (motorized and non-motorized) on elk winter range; and the need to provide quality forage for elk across seasonal ranges.

Over the past year, as a way to beta test the recommendations with elk relocation data, in 2015 Montana Fish, Wildlife & Parks and the Forest Service sponsored a post-doctoral student at Montana State University to use fine-scale location data collected during 2005–2014 to assess female elk resource selection during the archery and rifle hunting seasons in nine elk herds in southwestern Montana. These results include summer range selection, archery season selection, and rifle season selection. The summer range and fall reports are final and there are peer reviewed manuscripts in progress (Ranglack et al. 2016a; Ranglack et al. 2016b).

While most research and management has focused on the impacts of rifle hunting on elk, archery hunting has been increasing in popularity, with a 98 percent increase in archery license sales in Montana since 1985 (Montana Fish, Wildlife & Parks, unpublished data). As such, it is important to examine elk responses to archery hunting. Archery hunting has the potential to lead to reduced pregnancy rates and delayed conception in elk (Davidson et al. 2012). Nutritional condition of female elk during the late-summer and rut is also related to pregnancy rates and conception (Noyes et al. 2004; Cook et al. 2013). It is therefore possible that human disturbance associated with archery hunting may shift elk distributions away from areas of high nutritional resources, potentially impacting elk population dynamics further than would be expected through archery hunting mortality alone. Ranglack et al. (2016b) is recently available and summarized below. As indicated by the collaborative recommendations from 2013, some elk in this study selected for private lands not known to be accessible to public hunters during the archery season. One main finding that differs from the collaborative recommendations was that hunter density influenced elk resource selection during the fall. Elk were significantly more likely to use areas further from motorized routes as mean hunter effort in the annual range increased during both the archery and rifle seasons. As discussed in the collaborative recommendations, forest hiding cover was not selected by elk overall. Of the traditional security area metrics with a minimum block size of 250 acres at least 0.5 miles from a motorized route, 0 to 10 percent canopy cover (i.e., no canopy cover threshold) was the most supported. This validates the collaborative recommendation that the traditional security model derived from research in western Montana (Hillis et al. 1991) where forested blocks of similar canopy structure were important to elk during the stress of hunting season did not fit the conditions in southwest Montana where there is a natural mosaic of cover and openings. In the Ranglack et al. (2016b) analysis, elk selected for some low level of forest cover after which selection leveled off quickly and distance to a motorized route was more important.

In general, during the archery season, elk were more likely to use areas that were not known to be publicly accessible (private lands). Regardless of accessibility, elk were less likely to use hunting districts with higher hunter effort. Further, elk were more likely to use areas as distance to motorized routes, canopy cover, time integrated NDVI (a relative measure of nutritional value), and solar radiation increased, though distance to motorized routes and canopy cover quickly reached a pseudo-threshold at ≥1.71 miles and ≥13 percent respectively for publicly accessible lands, after which further increases in distance to motorized routes and canopy cover resulted in only small increases in elk resource selection. Elk were also more likely to use moderate slopes. All interactions improved model fit. Model results indicated that at high NDVI values, there was little difference in elk selection for areas near versus far from motorized routes, but at low NDVI values, elk were more likely to use areas far from motorized routes. Elk also were less likely to use areas with higher hunter effort if they were closer to motorized routes, but elk showed little response to increases in hunter effort far from motorized routes. Additionally, the difference in strength of selection for areas with high and low canopy cover was greater on publicly accessible lands than on lands that are not known to be publicly accessible. This same pattern was also found for the difference in the strength of selection for areas near and far from motorized routes.

Similar to the archery hunting season model, during rifle season elk were more likely to use areas that were not known to be publicly accessible (private lands). Regardless of accessibility, elk were more likely to use areas as distance to motorized routes, canopy cover, hunter effort, and solar radiation increased. Elk were less likely to use areas as elevation and snow water equivalent increased. Elk responses to distance to motorize routes, canopy cover, and hunter effort quickly reached pseudo-thresholds at ≥0.95 miles, ≥9 percent, and ≥3.44 hunter days/square mile, respectively, for publicly accessible lands, after which further increases in distance to motorized routes, canopy cover, and hunter effort resulting in only small increases in elk resource selection. Elk also were more likely to use moderate slopes.

The authors concluded that elk responses to hunting risk during the archery season were similar to elk responses during the rifle season and that travel closure dates should acknowledge this relationship. They even suggested that some routes may be able to be re-opened for rifle season and this might have the effect of keeping elk on public land for the archery season. Nutrition is very important to elk during summer, somewhat important during archery season, and then snow depth becomes important during the rifle season. They recommended that managers assess the balance between hunter pressure and motorized routes in their area and consider wildlife related travel closure dates during both archery and rifle hunting season in areas of high hunter pressure (≥12.75 hunter days/square mile), or hunting seasons that limit hunter pressure in areas of high motorized route densities. The information from this study daylights the need for state population managers and Federal land managers to be working closely together to manage elk and their fall habitat. Based on their results, the authors felt that the traditional Hillis et al. security area be replaced (in southwest Montana) by security areas being defined as having ≥13 percent canopy cover that are ≥1.71 miles from a motorized route during the archery season, with no minimum block size requirement, and as having ≥9 percent canopy cover that are ≥0.95 miles from a motorized route, that are at least 5,000 acres during the rifle season.

The old and new security area models are summarized in Table 9 below for each analysis area. The Hillis et al. (1991) model was run relative to routes open September 1 through November 30. Generally speaking, the Hillis model (run without the cover requirement) predicts much higher levels of security areas than the model derived from elk resource selection in southwest Montana. If the new paradigm is more accurate than Hillis et al. (1991) for the one analysis area that was included in the study (Madison, Henrys, Gallatin, and Absaroka Beartooth Mountains), it may help explain why elk redistribution to private lands often occurs during the archery season and those elk then are not available to the average public hunter. The new paradigm suggests that hiding cover is not the key habitat feature that elk select under pressure. It also suggests the importance of Montana Fish, Wildlife & Parks and Forest Service working together to balance hunter access (travel management) and hunting pressure (regulations). Ranglack et al. (2016) cautioned about extrapolating resource selection inferences to areas outside of southwest Montana. Therefore, although, displayed, the Ranglack model results for the Bridger, Bangtails, Crazy Pryor, Ashland, and Sioux analysis areas most likely do not reflect resource selection by elk that inhabit those areas. In those areas, the Hillis paradigm, without a hiding cover constraint, can help inform project level effects on elk.

Table 9. Comparison of security paradigms across the planning area during archery and rifle seasons

Area	Security Paradigm	Archery	Rifle
Madison, Henrys, Gallatin and Absaroka Beartooth Mountains	Hillis et al. (1991) Ranglack et al. (2016)	72% 23%	72% 29%
Bridger, Bangtail, and Crazy Mountains	Hillis et al. (1991) Ranglack et al. (2016)	50% 80%	50% 11%
Pryor Mountains	Hillis et al. (1991) Ranglack et al. (2016)	34% 0.2%	34% 0%
Ashland District	Hillis et al. (1991) Ranglack et al. (2016)	33% 0.6%	33% 0%
Sioux District	Hillis et al. (1991) Ranglack et al. (2016)	29% 0.1%	29% 0%

Summer Habitat. The Ranglak et al. (2016a) model indicated that during summer, cow elk selected for areas of high nutrition. The effect of motorized routes varied by elk herd, but generally was dramatically overshadowed by nutrition as represented by a time integrated greenness index (NDVI). In areas of poor nutrition, elk avoided motorized routes; and in areas of good nutrition, elk did not avoid motorized routes. The report recommends that the current elk summer habitat management paradigm based on managing motorized route density to maintain elk habitat effectiveness (Lyon 1983) be expanded to also consider nutritional resources, and that managers assess the relationships between time integrated NDVI and existing vegetation mapping products (e.g., R1VMAP) to determine the types of areas within their jurisdiction that contain optimal NDVI values (i.e., values ≥66). High values should be evaluated with respect to fire, grazing, weed treatments, etc. to help managers understand the relationships between management actions and summer range elk nutrition. Low motorized route densities may, in some cases, compensate for sub-optimal nutrition. Wisedom et al. (2005) found that in northeast Oregon, elk responded both to the presence of motorized routes and the level of traffic on those routes.

Overall, areas of high nutrition are rare (Figure 10) and seem to be associated spatially with north aspects and high elevations (Figure 11). Around 3,000 acres were recently burned forests. Proportionally, compared to low nutrition areas (class 0–1), optimal nutrition areas included more “wet grass”, shrub and deciduous tree lifeforms and less tree lifeform. Proportionally, compared to low nutrition areas, optimal nutrition areas included less of all the conifer cover types except spruce with a notable small proportion in whitebark pine cover types and in recently burned or transitional forest types. Relative to tree size class in the forested areas, there was not a notable difference between nutrition classes except that optimal nutrition areas were more often in the 15” plus tree size class compared to low nutrition areas. Low nutrition areas were more likely to have high (60 percent plus) canopy cover than higher nutrition areas. Four classes of relative nutritional quality using time integrated NDVI are summarized (existing condition) below by analysis area. The classes were based on parameters from Ranglack et al. (2016a).

Madison, Henrys, Gallatin and Absaroka Beartooth Mountains

These Montane areas have optimal elk summer nutrition (NDVI >66) on only 4 percent of this composite landscape or about 83,300 acres. Class 2 (NDVI 56–65) makes up 19 percent of this area or about 445,800 acres, and class 1 (46–55) comprises 35 percent or 807,800 acres. Forty-two percent of this area is class 0 or would not be considered good elk summer range.

Bridger, Bangtail, and Crazy Mountains

These Montane areas north of I-90 include 3 percent in optimal nutrition or 9,200 acres; 36 percent in class 2 or 104,800 acres; 36 percent in class 1 or 104,000 acres; and 25 percent in class 0 or 74,150 acres would not be considered good elk summer range.

Pryor Mountains

This isolated mountain range includes 1 percent optimal nutrition; 15 percent in class 2; 24 percent in class 1; and 60 percent would not be considered good elk summer range (class 0). This may help explain why there are no resident elk in this landscape.

Ashland District

According to this model, which was derived from elk resource selection in southwest Montana, Ashland has only 1 percent in class 1 and 99 percent in class 0, which is not considered good elk summer range. There is a growing elk population on this District; therefore, the model results are probably not transferable to eastern Montana. Ranglack et al. (2016) cautioned about extrapolating resource selection inferences.

Sioux District

The Sioux District, which has few elk, has 3 percent in class 1 and 97 percent in class 0. Conclusions are similar to the Ashland District in that the model results are likely not transferrable.

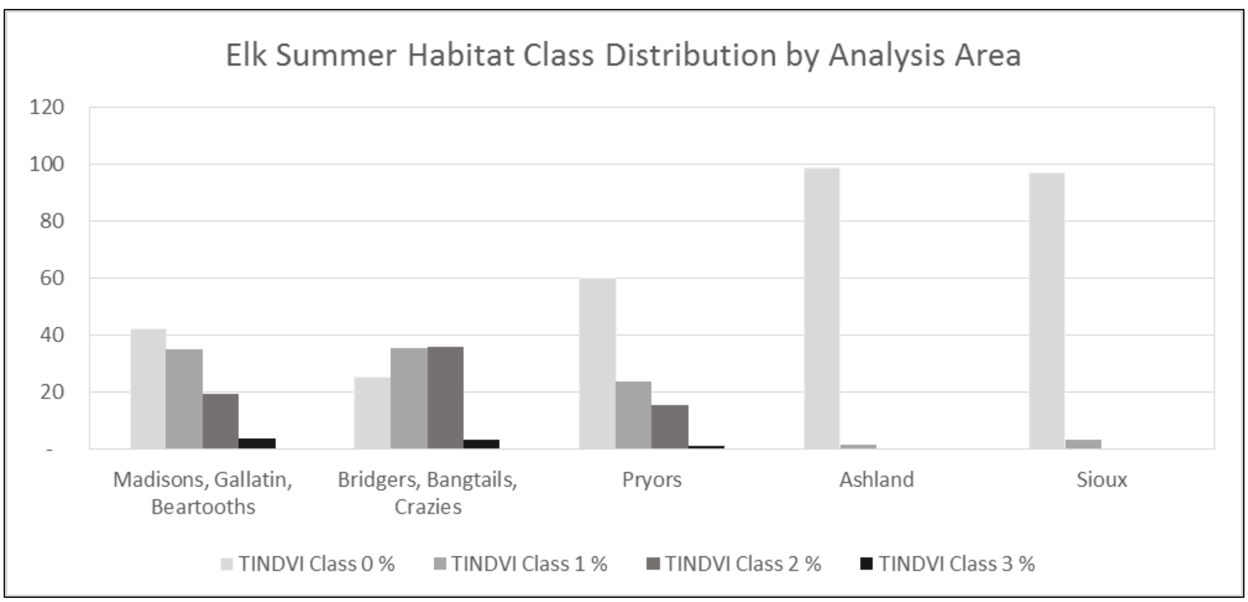

Figure 10. Elk summer habitat class distribution by analysis area

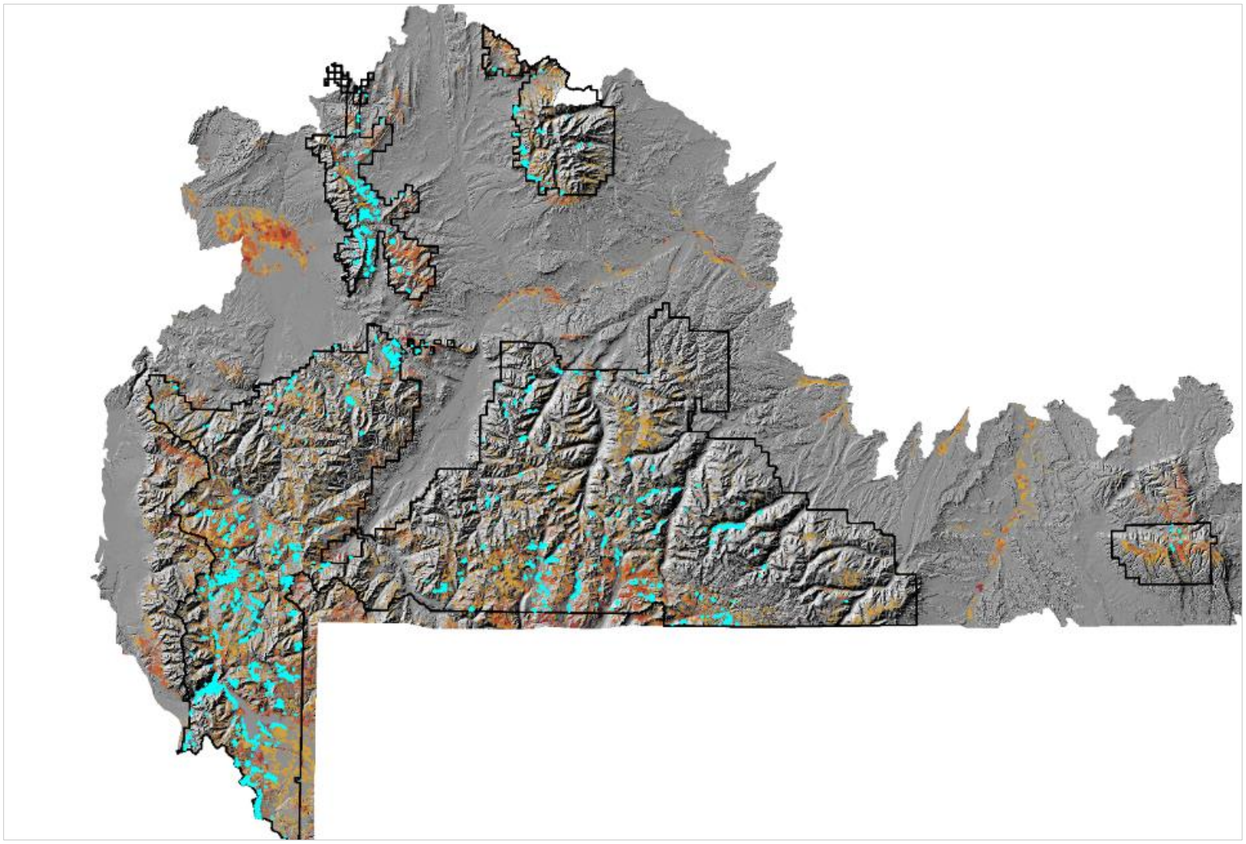

Figure 11. Blue highlights represent optimal foraging areas for elk based on high (class 3) NDVI

Key Benefits to People

Key Contributions to Social and Economic Sustainability from Ecosystem Services, Multiple Uses, Infrastructure and Operations

Accessible elk populations on public land provide the obvious recreation benefits for hunting and viewing wildlife, and also tribal and cultural values (these addressed elsewhere), but also provide for maintaining a robust predator community on public land in that many key predators (e.g., grizzly bears, black bears, cougars, wolves) utilize or scavenge live and dead elk as prey.

Other key benefits of elk include the economic opportunity for wildlife based employment for outfitters and guides and biologists in the private sector and for biologists who work for state and Federal agencies. Elk also support opportunities for student research at academic institutions such as Montana State University.

Trends and Drivers

The goal to maintain elk on public land is sometimes complicated by the management of adjacent private lands in ways that provide a "refuge" for elk due to unnatural foods such as alfalfa and/or reduced or no hunting pressure. The risk with those situations is that elk populations cannot be controlled by hunting and expanding elk populations could negatively affect other private lands that are working livestock ranches.

The trend suggested by the data from Montana Fish, Wildlife & Parks and our habitat models is that elk will continue to be displaced from some public lands during the hunting season—likely that redistribution will occur during the archery season due to increasing numbers of hunters on the landscape at this time of the year. This trend will be influenced by travel management, and route closures starting in early September that could help this situation are likely to be unpopular with much of the public.

Elk habitat will be influenced by natural succession of vegetation, which by itself, will reduce forage as trees spread into meadows and smaller trees fill in between larger trees. This may be mitigated by the use of prescribed fire or wildland fire. However, because of the widespread occurrence of invasive plant species, the use of or occurrence of more fire on the landscape could exacerbate the impact of invasive species on reducing elk forage. With the current trend of small thinning projects in the wildland urban interface, it is unlikely that timber harvest will be of value in increasing elk forage or improving the NDVI nutrition indices across the forest. Climate change may improve forage if the growing season is extended and elk can access high quality green vegetation for more of the year. A disturbance regime (fire, thinning, and patch cuts) with spatial heterogeneity at reasonably fine scales will favor ungulates (Halofsky et al. 2016). At the present levels of livestock grazing on much of the Custer Gallatin National Forest, it is unlikely that livestock use has much effect on elk habitat within the Montane portions of the Forest. However, it is possible that livestock grazing on the Ashland and Sioux landscapes may become a limiting factor on the availability of forage for another large ungulate such as elk, particularly if climate change warming is not offset by increased precipitation.

Human use is known to influence elk habitat and use. Vegetation management can alter elk habitat in ways that may have positive, negative, or neutral effects for wildlife, by increasing forage, reducing security cover, or both. Human access and associated disturbance can also impact elk, as described above in terms of the effects of road access relative to elk habitat security. Winter use by humans can have disproportionate effects on elk, because winter habitat is limited by poorer quality forage, coupled with increased energy demands created by cold temperatures and movement through snow. For bull elk, winter energy requirements can be intensified by poorer overall condition resulting from injuries and/or increased physical activity associated with the fall breeding season (Oliff, et al. 1999). Winter recreation use can cause disturbance effects, which may result in increased energy expenditure for elk through both physiological reactions to noise and disturbance as well as forced movement away from such disturbance. Such impacts from humans, coupled with energy demands required to avoid wolves and other natural predators, can affect elk population trends.

Information Needs

The largest gap in information about elk is on the Ashland and Sioux Districts, where elk populations have increased, but have not yet been studied for insight on elk use public lands, or what drives seasonal resource selection. We also lack information on what threshold of security areas (percent of an elk herd home range) might reverse the trend of redistribution onto private lands.

Key Findings

Elk in southwest Montana did not select areas with high canopy cover even during the stress of hunting seasons. Therefore, the emphasis on hiding cover found in the Gallatin Forest Plan may no longer reflect current habitat conditions or needs for elk. In southwest Montana (represented on the Custer Gallatin National Forest by the Madison, Gallatin, Absaroka Beartooth landscape), the management of motorized routes and high quality forage are the most important variables for elk during the summer and fall seasons. There are opportunities to work with Montana Fish, Wildlife & Parks in areas where elk are leaving public lands during the hunting season using habitat manipulation to increase deciduous forest (aspen) and grass and shrub communities to increase areas with high nutritional value. In some areas, travel management changes may encourage elk to remain on public land; conversely, changes in hunting season regulations may be needed to limit hunter densities in some areas. There is a need to better understand elk resource selection on the Ashland and Sioux Districts. Habitat effectiveness and security (Hillis 1991) can still be useful in understanding elk habitat relationships, especially for the mountain ranges and analysis areas not included in the resource selection model.

Moose

Existing Condition

Population

Moose are found on all of the Montane areas of the Custer Gallatin National Forest, and are not residents of the Pryors, Ashland, or Sioux landscapes (although there are observations from time to time). Population trends are not well monitored, but in one area—the Hegben Basin near West Yellowstone, it appears that record moose numbers occurred in the 1960s and then the population plummeted possibly due to hunter overharvest, habitat loss from timber harvest, and/or predation (Cunningham 2015). Over the past few years, the Hebgen District has cooperated with Montana Fish, Wildlife & Parks to survey moose. The only observable pattern is that moose rely on the willow bottoms along the lake in the winter and move as quickly as they can in the spring to higher elevations. In the spring of 2016, a helicopter survey for moose was conducted by Montana Fish, Wildlife & Parks in the Main and West Boulder drainages of the Absaroka and Beartooth Mountains (Hunter District 516). Four moose were observed. The Region 5 Montana Fish, Wildlife & Parks report (W-130-R-46) states that moose sightings in this district are highly variable making trend analysis impossible. From 2007 to 2016 the range of sightings was 0 to 15. Spring 2016 surveys were completed in Hunter District 514 (Beartooth Face) and Hunter District 513 (Stillwater and Rosebud drainages). Nine moose were observed in Hunter District 513, which is substantially less than the average of 38 moose seen from 1996 to 2001. A total of 54 moose were counted in Hunter District 514 which is on par with the long-term average for this Hunter District, and hopefully indicates an upturn from a period (2006 to 2012) when moose counts were at an average of 23.

Statistically reliable population trend estimates for the past two decades are unavailable, but moose populations appear to be declining. Number of hunting permits issued have been reduced, and statewide observations turned into the Montana Heritage Program have also declined (Figure 12).

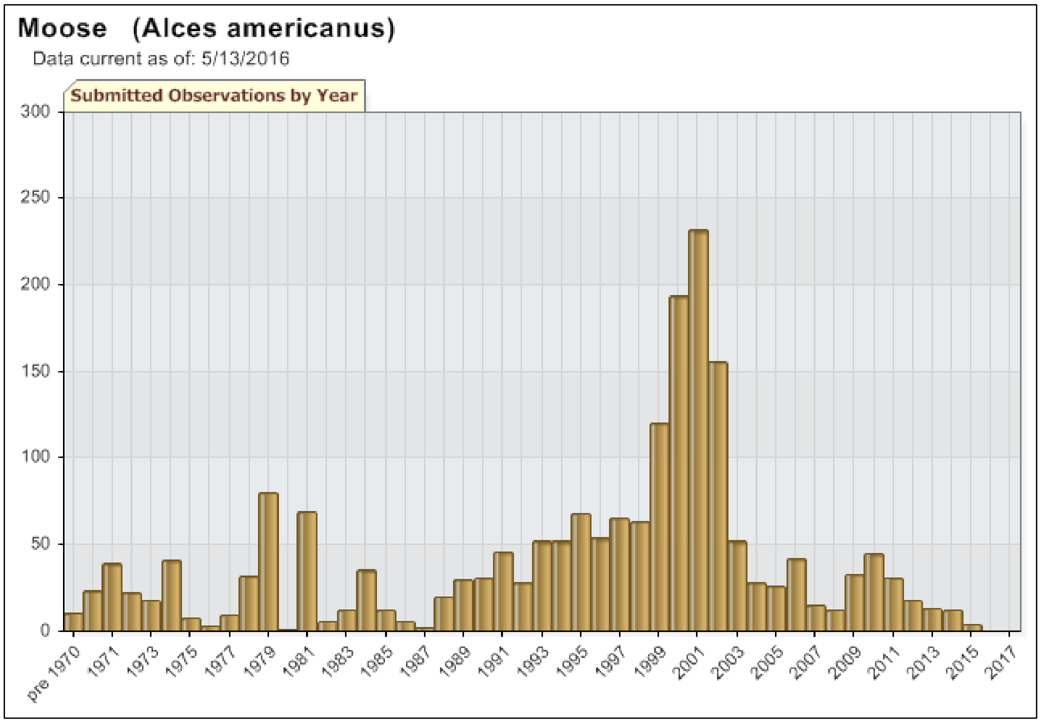

Figure 12. Statewide observations of moose in Montana (per the Heritage database)

Moose observations reported to the Montana Natural Heritage Program have declined in recent years (Figure 12). Montana Department of Fish, Wildlife and Parks, in an interview with the *New York Times*, noted that there are fewer moose out there, and hunters are working harder to find them (Robbins 2013). The hypothesis for the decline is climate change. Moose are adapted for cold weather, and when the temperature rises above 23 degrees Fahrenheit in winter, as has happened more often in recent years, they expend extra energy to stay cool. In addition, the warmer weather may result in higher tick loads or other parasites or diseases (DeCesare and Newby 2013).

Local population decline or even disappearance is not atypical across the global range of moose. Moose populations can be highly cyclic, following a pattern of eruption, crash, and stabilizing or disappearing for varying periods of time. Also, juxtaposed populations may be at very different stages. Some subpopulations across a landscape, such as the Greater Yellowstone Ecosystem, may be declining while others are stable or increasing (Tyers 2010). Recent work on the northern range of Yellowstone National Park using DNA as a population estimation technique showed 82 moose as a minimum population count with the majority of the females pregnant (Koitzsch et al. 2014). They found four distinct subpopulations, which included the Slough Creek population that extends onto the Custer Gallatin National Forest.

Although there is some concern for moose, Montana Fish, Wildlife & Parks does issue permits that provide some limited hunter opportunities. With the exception of Hunting District 513 which allows for four either sex permits, all hunting districts overlapping with the Custer Gallatin National Forest limit harvest to a few bulls or have closed seasons (316, 317, 318, 328). There are a total of 43 moose permits available for Custer Gallatin National Forest hunting recreationists.

Habitat

Winter is a critical time of year for moose because forage quality and availability are low, and energetic costs of moving through deep snow and maintaining body heat in cold temperatures are high (Canfield et al. 1999). Unlike ungulates in the northern Rocky Mountains that migrate to lower elevation valleys with less snow accumulation, moose may remain at higher elevations with greater snow accumulation. Winter habitat for moose is variable across their range, but always includes concentrations of accessible browse. Willow and aspen are among the most palatable browse species to moose. These species are often heavily used if snow conditions allow. At snow depths of around 30 to 40 inches, moose will shift from open shrub fields to dense stands of conifers where snow depth is ameliorated by canopy cover and shading reduces crusting of snow. In the Greater Yellowstone Area, older lodgepole pine forests with subalpine fir in the understory were found to be heavily used by moose under such conditions. Subalpine fir is a preferred winter browse species for moose (Tyers 2003; Koitzch et al. 2014). Vegetation management in traditional moose winter range can affect moose by altering foraging habitat. Winter recreation use can also impact moose by triggering physiological responses to disturbance, and or flight from disturbance, both of which increase energy expenditure during a critical time (Oliff et al. 1999).

Moose response to habitat disturbance varies substantially across their range. In many areas, early successional conditions created by fire or logging are beneficial because they result in vigorous regeneration of palatable browse species. However, the relationship of moose to ecological disturbances in the Greater Yellowstone Area appears to be different. In this area, older lodgepole pine stands are among the most important wintering areas, especially under severe conditions when moose are the most vulnerable. When subject to disturbance, these stands typically regenerate with high densities of lodgepole pine seedlings rather than palatable woody shrubs. These stands do not provide winter habitat for moose until shade-tolerant subalpine fir saplings begin to achieve adequate densities under the aging lodgepole pine canopy. Tyers (2003) found little or no moose use of lodgepole pine stands less than 100 years old, and highest use of lodgepole pine stands greater than 300 years old during mid-late winter on the Northern Yellowstone Winter Range. He also reported a precipitous decline in the Northern Yellowstone moose population following the 1988 fires, which burned approximately 35 percent of his study area and 29 percent of the mature forest in the study area (Tyers 2003). The losses of subalpine fir browse and canopy cover to ameliorate snow depth were the factors deemed responsible for causing this decline.

Key Benefits to People

Intact and accessible moose populations on public land provide the obvious recreation benefits for hunting and viewing wildlife, and also tribal and cultural values (these addressed elsewhere), but also provide for maintaining an intact predator community on public land in that many key predators (e.g., grizzly bears, black bears, cougars, wolves) utilize or scavenge live and dead moose as prey.

Other key benefits of moose include the economic opportunity for wildlife based employment for outfitters and guides and biologists in the private sector and for biologists that work for state and Federal agencies. Moose also provide for student research at academic institutions such as Montana State University.

Trends and Drivers

Moose are regarded as a boreal forest species; as such, climatic conditions in the lower 48, may affect their distribution and population dynamics. Heat stress may cause physiological stress, increasing moose vulnerability to disease, parasites, and other sources of mortality, as well as potentially decreasing reproductive success. If average annual temperatures increase in Montana, maintaining habitat that provides foraging opportunities (willow and other browse species, or forest openings) that is in close proximity to habitat that provides thermal relief, such as closed canopy conifer or aspen stands, and wetlands, may be important to sustaining moose populations.

Although moose are the largest ungulate in North America, they are vulnerable to predators. Their solitary habits and to some extent the habitats they use may provide predators with more opportunity than exists for preying on elk, for example, because of the latter's gregarious nature and habit of frequenting open areas where predator presence may be more readily detected. Deep snow habitats used by moose may also make them more vulnerable to predators that are able to travel on top of crusted snow. Wolves have been known to prey on moose; in an area of the North Fork of the Flathead River where moose were relatively abundant, wolf diets shifted to include more moose in winter, when other prey such as elk and white-tailed deer became less available (Kunkel et al. 1999). Grizzly bears may prey on moose calves in areas where grizzlies are relatively abundant, such as the Rocky Mountain Front (DeCesare and Newby 2013).

Information Needs

Not much is known about many of the moose populations in the state; however, Montana Fish, Wildlife & Parks, with help from Montana State University, has synthesized research needs and has initiated several moose studies (Smucker and Gude 2011).

Key Findings

Moose populations are in decline and that may be a function of the interplay of climate change with preferred habitats, parasites and disease and its effect on physiology and reproductive health, and predation by carnivores and humans. Habitats important to moose include mature forest stands in close proximity to willow bottoms and/or aspen.

Bighorn Sheep

Existing Condition

Population

Bighorn sheep occur throughout western North America, extending northward into southern and central British Columbia and Alberta, and southward into Mexico. Today, in Montana, there are 45 distinct bighorn populations and an estimated 6,000 animals. These herds are either isolated or exist in a meta-population structure, with very limited exchange of individuals among herds (Montana Fish, Wildlife & Parks 2010). On the Custer Gallatin National Forest, there are bighorn sheep herds in the Absaroka and Beartooth Mountains, the Madison and Gallatin Ranges, and in the Pryor Mountains (Figure 13). Establishment of bighorn sheep in the Bridger Bangtail Mountains has been considered by Montana Fish, Wildlife & Parks at least twice, and the conclusion has been that the distribution of domestic sheep on private lands in close proximity to the national forest is a substantial threat to a successful reintroduction of bighorn sheep.

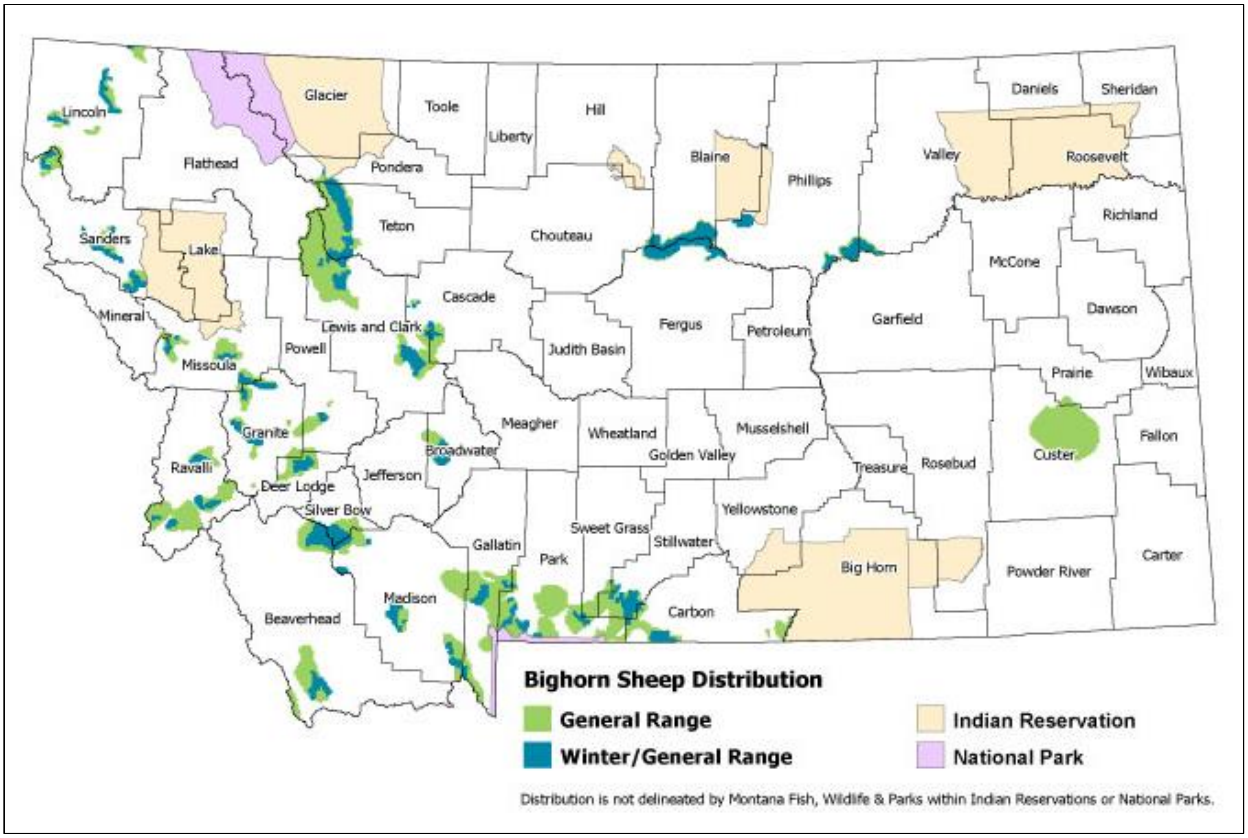

Figure 13. Distribution of bighorn sheep in Montana

Bighorn sheep were thought to be numerous in Montana historically and were used by Native Americans and the early explorers for food and to make tools (Montana Fish, Wildlife & Parks 2010). The settlement of the West led to significant declines of bighorns and other big game species because of range competition with livestock, contact with domestic sheep (and subsequent contraction of disease resulting in die-offs), and subsistence hunting (Montana Fish, Wildlife & Parks 2010). Attempts to save sheep included artificial feeding along the Gardiner River in 1919 before the area was included in Yellowstone National Park. By 1930, bighorn sheep were reduced to small remnant bands. Since then restoration efforts have included improving range conditions, establishment of game ranges (e.g., the Sun River Game Range is home to the largest bighorn sheep population in Montana), and transplants, which started new populations (mostly after 1960) (Montana Fish, Wildlife & Parks 2010). However, in recent years, sheep numbers have declined statewide beginning in late 2009, by as much as 10 percent to 20 percent by 2011, due to pneumonia-associated die-offs and subsequent poor to nonexistent lamb recruitment in herds that had experienced disease (Montana Fish, Wildlife & Parks 2010,; Garrott et al. 2015). The Northern Region of the Forest Service included bighorn sheep on its revised sensitive species list in 2011. Rationale included that bighorn sheep numbers were only 10 percent of their historical populations and they only occupied one-third of their pre-settlement habitat. The rating was also based on the threat from all-age epizootic die-offs and the acknowledgement that there were 21 open active domestic sheep allotments in the Northern Region. None of these allotments occurs on the Custer Gallatin National Forest.

Recent data shows that there is substantial variability in baseline productivity of bighorn populations in Montana (22 to 49 lambs per 100 ewes), which is not correlated with ecoregions, precipitation patterns or any index of habitat quality, but that does appear to be correlated with population size (Garrott et al. 2015). This Montana study has documented that many populations are small and isolated and therefore may be marginally viable. They also note substantial variability in body condition among and within bighorn sheep herds. Generally speaking, females show strong fidelity to a home range, whereas males are more likely to make longer movements that overlap not only neighboring herds, but also domestic sheep operations. This is a plus in providing for genetic exchange between herds and a minus in terms of potential mingling with domestic sheep and contracting any of seven potential respiratory pathogens (DeCesare and Pletscher 2006).

Information about populations on the Custer Gallatin National Forest are detailed in the tables and narrative that follows.

Madison, Henrys, Gallatin and Absaroka and Beartooth Mountains

Absaroka and Beartooth Mountains: There are three herds of bighorn sheep found on the Beartooth Unit of the Beartooth Ranger District (Table 10). The Beartooth herd uses both sides of the West Rosebud drainage, wintering at high elevations in the wilderness and migrating to the Cooke City area (Gardiner Ranger District) during the summer (Scotch Bonnet Peak). Trend Counts range from 19 animals in 1976 to 100 in 1986. The local Montana Fish, Wildlife & Parks biologist indicated that only eight sheep were seen in 2015; however, he suggests that there may have been a change in winter distribution and that Montana Fish, Wildlife & Parks has not been surveying the right areas. The Hellroaring herd uses high elevation habitat south of the town of Red Lodge. This herd averaged about 60 to 100 sheep annually until 1991 when a late winter blizzard blanketed the winter range and killed most of the sheep. The survey count in 1992 was 19 sheep but only 11 were found in 1993. The herd has been slowly recovering and is estimated at around 40 to 60 sheep and is stable to slightly increasing (Stewart, S. 2016, personal communication). The Stillwater Mine herd is a subset of the Boulder Bighorn Sheep complex and is the only low elevation winter range within this area (Montana Fish, Wildlife & Parks 2010). These sheep are wintering on areas reclaimed during the mining process and have abandoned their historic winter range.

The Monument herd in the Main Boulder on the Yellowstone Ranger District (Table 10) is unique in that it has never been augmented and that in hard winters, sheep use the wind-swept high elevation ridges and mountain peaks. Trend counts for this population have varied from 24 to 60 since 1972 and seemed to increase after a domestic sheep allotment on the Gallatin National Forest became inactive in 1996 (and retired in 2006). This herd is sympatric (i.e., shares its range) with mountain goats yearlong. Montana State University has been studying potential competition between mountain goats and bighorn sheep in the Greater Yellowstone Area, and found no evidence that growth rates were significantly lower for bighorn sheep herds that shared ranges with mountain goats than growth rates for sheep herds where goats are absent. They cautioned however, that mountain ungulates are difficult to survey and there is varying detection probability that obscures the true nature of population increases and declines (Flesch and Garrott 2011). This mountain ungulate project is ongoing. Recent work has shown that Greater Yellowstone Area mountain goat populations host all of the pathogens associated with disease in bighorn sheep, and thus represent a potential vector for disease (Garrott, R., 2016, personal communication).

Table 10. Bighorn sheep herd hunter opportunity and potential habitat issues

Bighorn Sheep Herd	Hunting District	Recreation Provided	Issues
Beartooth Mountains	501	Quota of 2 legal rams; average of 76 licenses sold	Possible population decline; invasive plants on summer range
Hellroaring (Rock Creek)	502	2 legal ram quota; average of 75 licenses sold	Sympatric with mountain goats; snowmobile incursions into wilderness on winter range
Stillwater Mine	500a	Contributes rams to Hunter District 500	Winter on Stillwater mine reclamation areas; invasive plants; predation
Monument Peak	500	2 legal ram quota; unlimited permits	Snowmobile incursions in wilderness on winter range
Upper Yellowstone Complex South Absaroka	303 and 304	304 is closed to hunting currently and 303 has a quota of 2 legal rams; unlimited permits	Disease and proximity to domestic sheep; predation; invasive plants
Upper Yellowstone Complex Gallatin-Yellowstone (Tom Miner)	300	Quota of 2 legal rams; unlimited permits	Sympatric with mountain goats; livestock grazing; invasive plants; high recreation use in the area
Upper Yellowstone Complex Hyalite	304	304 is closed to hunting currently due to a disease event	Lack of access for hunting; wolf predation; invasive plants
Upper Yellowstone Complex South Yellowstone	305	305 is currently closed to hunting; usually a quota of 1 legal ram	Competition with other ungulates in Gardiner Basin
Upper Yellowstone Complex Mill Creek	Not Hunted	NA	Large wildfires in 2006–2007 may create better habitat
Spanish Peaks	301	5 any ram licenses	Highway mortality; loss of habitat due to development; invasive plants on winter range (Big Sky); domestic sheep near Bear Trap Canyon
Hilgard	302	5 ewe quota and 6 ram quota	Historic feeding by private landowner; sympatric with mountain goats on summer range; invasive plants on winter range

Gallatin Range: The Upper Yellowstone bighorn sheep complex is comprised of nine small, interconnected native subpopulations, some of which travel across the stateline into Yellowstone National Park and back (Montana Fish, Wildlife & Parks 2010). These populations are surveyed in five distinct areas (Table 10). Given the mix of sheep that can be hunted and sheep that reside in Yellowstone National Park during the hunting season is challenging relative to management of harvest levels (Montana Fish, Wildlife & Parks 2010). Trend survey data from 2016 included a count of 170 sheep in the Montana portion of the Upper Yellowstone, and 150 in Yellowstone National Park. This is about 10 percent lower than the previous 10 year average and 21 percent higher than the previous 21 year average. A portion of the Montana population exhibited declines in 2015 due to an all age pneumonia event. Montana Fish, Wildlife & Parks in their trend count report (Loveless 2016) indicated that the risk of disease related mortality seems to be density dependent such that managing (through harvest) numbers below some threshold may prevent additional die-offs. This population in Hunter District 304 has been closed to hunting since 2013. The more southern population (Hunter District 305) has been closed since 2015 due to a decline in mature rams.

Within the sub-population called the Gallatin-Yellowstone (Table 10), currently about 70 sheep winter at higher elevations in Tom Miner Basin (Hunter District 300) and mix with the other sheep (20 that winter on private land at lower elevation) on summer range. These are hunted with a quota of two legal rams, but with no limit on permits issued. The sheep that winter on private land have had contact with nearby domestic sheep (Montana Fish, Wildlife & Parks 2010).

The sub-population called the South Yellowstone (Table 10) occupies the west side of the Yellowstone River south of Sphinx Creek. During the winter, bighorn sheep in this area compete with many other ungulates that leave Yellowstone National Park to find winter range. This herd suffered a die off in the 1980s but has recovered and consists of about 100 animals.

The sub-population called Hyalite (Table 10) currently includes about 70 native sheep that are sympatric with mountain goats on summer range around Hyalite and Fridley Peaks. They winter on private land near Point of Rocks.

There is a small population (about 20 sheep) in Mill Creek (Table 10) which was established in 1985 and included 7 transplants from northwest Montana along with 13 sheep from a nearby native herd. There is no hunting season established for this herd.

Madison Range: The Spanish Peaks bighorn sheep population is a native herd that occupies lands managed by the Custer Gallatin National Forest (Lee Metcalf Wilderness) as well as other lands (Beaverhead-Deerlodge, BLM, lands managed by the state of Montana, private lands). They were at an all-time high level in 2010 (212) prior to heavy winter mortality during the winter of 2010–2011. Trend surveys indicate that they have recovered and the count in 2016 included 170 sheep. To manage the population level, 15 ewe licenses will be issued in 2016 (Cunningham 2016). This herd winters along the Gallatin Canyon and sheep are often seen while driving Highway 191.

The Hilgard bighorn sheep population winters near Quake Lake partially on the Custer Gallatin and partially on the Beaverhead-Deerlodge National Forest. This winter range was considered over-populated and therefore Montana Fish, Wildlife & Parks decided to transplant sheep to a historic winter range (Wolf Creek) to the north and increase dispersion along the Madison Range. During 2015–2016 74 sheep were captured and relocated. Although some of these sheep (based on radioed animals) returned to the capture site, some remained in Wolf Creek, and some colonized adjacent areas (Indian and Bad Luck Creeks) (Cunningham 2016). These sheep summer on the crest of the Madison Range and are sympatric with mountain goats. Additional bighorn sheep summer in the Madison Range (74 seen on Sage Peak in 2014), but it is unknown where they winter.

Pryor Mountains: The Pryor Mountain herd is mainly found on lands managed by the BLM and the Bighorn Canyon National Recreation Area, but may occasionally occur on the Custer Gallatin portion of the Pryor Mountains around Crooked Creek (Table 11). Comprised of transplants from Wyoming and Montana, this herd has good genetic diversity and the population seems healthy with good lamb recruitment (Montana Fish, Wildlife & Parks 2010). Trend counts have ranged from 31 to 85 animals.

Table 11. Bighorn sheep herd hunter opportunity and potential habitat issues in the Pryor Mountains

Bighorn Sheep Herd	Hunting District	Recreation Provided	Issues
Pryor Mountain	503	1–4 legal ram permits	Sympatric with wild horses; proximity of domestic sheep and goats

Habitat

Bighorn sheep in Montana are adapted to a wide variety of habitats. Although habitats may vary across the state in relation to vegetation types, ruggedness, elevation, etc., there are attributes of habitat that are consistent across ecological regions. These attributes, to a large degree, influence the ability of a population to achieve its potential. Three elements are considered essential to quality bighorn habitat; these are also the attributes that can be potentially degraded by plant succession or human activities (Montana Fish, Wildlife & Parks 2010; DeCesare and Pletcher 2006).

1. Escape cover or terrain is a common element in all seasonal habitats. Bighorn sheep, especially ewes, are generally found within 100 to 300 meters of escape terrain. Escape terrain is comprised of slopes 60 percent or greater with occasional rock outcroppings. Escape terrain also has abundant open foraging areas adjacent to it. Areas with dense timber tend to receive little use except in areas in the Northwest Montane ecological region where bighorns have adapted to timbered habitats.
2. High visibility in all bighorn habitats is recognized by most biologists as being highly important in the detection and avoidance of predators as well as access to forage and foraging efficiency.
3. Winter range areas tend to be low elevation, south-facing slopes with escape cover in proximity to foraging areas. Winter range is defined as all escape terrain, which receives less than 25 centimeters (approximately 10 inches) of snowpack. A unique characteristic of bighorn sheep winter range in the West Rosebud drainage (Beartooth Range) and the Southern Mountains ecological region is that sheep winter on high elevation windswept slopes and migrate to lower elevations prior to lambing.

Bighorn sheep forage opportunistically and utilize vegetation types that occur within their seasonal distribution. With few exceptions, bighorns utilize forbs heavily in the spring when they are readily available. As forbs desiccate during summer, diets switch to more grass and grass-like plants. Some bighorn populations make substantial use of browse species at certain times of the year. Stewart (1975) found that in the West Rosebud Herd, which winters on the high-elevation Beartooth Plateau and migrates to lower elevations in late winter, diets were comprised of as much as 40 percent big sagebrush (*Artemesia tridentata*). DeCesare and Pletscher (2006) found that sheep selected for burned areas and avoided dense forests.

Major habitat issues include:

- Livestock grazing has in some cases been detrimental to bighorn sheep habitats. The type of fencing used on some domestic livestock grazing allotments can impede bighorn sheep movements. Wild horses have degraded wildlife habitats in a few areas in Montana. Conversion of grazing allotments on public lands from cattle to domestic sheep in areas adjacent to known bighorn sheep distribution has, at times, been an issue. This situation is a habitat as well as a health issue for bighorn sheep. Sheep and goats are often used as pack animals in back-country situations and these animals can pose risks to bighorn sheep.

- Residential and resort developments have had a major impact on some seasonal ranges resulting in direct loss of habitat, fragmentation of habitats, and displacement of bighorns to less productive habitats.
- Highway development and maintenance has fragmented some habitats making connection between subpopulations more difficult. Maintenance of highways, particularly during winter when salting occurs, has attracted bighorns to roadsides resulting in significant vehicle collision losses in some populations. The type of fencing used along highways can impede movements. Illegal use of ATVs on public lands has in some cases been detrimental to bighorn habitats.
- Industrial developments such as dam development, hard rock mining, oil and gas development and exploration, and electrical transmission lines have resulted in direct loss of habitat, deterioration of habitat, reduced bighorn populations, displacement to less productive habitats, and fragmentation of existing habitats.
- Forest succession or woody plant encroachment into former grasslands or shrub grasslands, caused in part by historical overgrazing by livestock and fire suppression efforts, has resulted in loss of habitat including linkages between habitats and subpopulations.
- Noxious weeds, especially in the western part of Montana, have resulted in the loss of productivity of seasonal ranges. The use of domestic animals for weed control is an emerging issue that has potential for displacement of bighorn sheep and also is a serious health issue to bighorn sheep should contact occur.
- Competition for forage with other wild ungulate species has not been a serious issue in most bighorn populations in Montana to date but has the potential to be so in places with sympatric populations and limited forage.
- Human disturbance on critical winter and lambing ranges.

While most of the recent collaboration work in southwest Montana (Montana Fish, Wildlife & Parks and USDA Forest Service 2013) was for elk, the paper does include some guidelines for bighorn sheep, such as:

- The Forest Service should work collaboratively with Montana Fish, Wildlife & Parks to explore opportunities for re-establishment of bighorn sheep and/or maintenance of existing bighorn populations.
- Manage domestic sheep or goat grazing to achieve effective separation, reduce risk of association, and avoid range overlap with wild sheep.
- Ensure annual operating instructions issued to grazing permittees include measures to minimize association and identify strategies to deal with stray domestic sheep or goats.
- Develop and use best management practices to reduce straying by domestic sheep or goats.
- Manage and improve wild sheep habitat (re-establish native plants, burning, thinning) to promote healthy populations in areas away from where domestic sheep or goats are permitted.

Forest succession that results in understory development in open woodlands near escape terrain, or that results in encroachment of confers into grasslands near escape terrain, may result in bighorn sheep habitat loss. Fire can be a useful tool in maintaining openings and removing conifer cover that inhibits sheep use of some habitats. However, the timing of disturbance is important; fires that impact winter forage without adequate time for re-growth may create crowding on remaining range, or nutritional stress during winter.

The most important influence on bighorn sheep populations in Montana appears to be disease-related die-offs (Wild Sheep Working Group 2012). In addition to the direct mortality experienced in a die-off event, lamb:ewe ratios may remain chronically low for years after disease-related die-offs (Garrott et al. 2015). A group of biologists known as the Wild Sheep Working Group under the auspices of the Western Association of Fish and Wildlife Agencies conducted an exhaustive review of the literature and recent available data regarding known wild bighorn sheep die-offs, and concluded that domestic sheep and goats were the source of most or all disease resulting in those die-offs (Wild Sheep Working Group 2012). The group coined the term "effective separation", defined as "spatial or temporal separation between wild sheep and domestic sheep or goats to minimize the potential for association and the probability of transmission of diseases between species" (Wild Sheep Working Group 2012). Based on the body of evidence regarding the relationship between bighorn sheep-domestic sheep/goat contact and bighorn sheep disease-related die-offs, the group stated that "efforts toward achieving effective separation are necessary and warranted" (Wild Sheep Working Group 2012a). Montana Fish, Wildlife & Parks has attempted to establish buffer zones of up to nine miles between domestic sheep and goats and bighorn sheep populations (Montana Fish, Wildlife & Parks 2010) but this strategy has not always been successful. As some bighorn sheep herds expand in numbers and distribution, the established buffer zone may break down and they may come in contact with domestic sheep or goats.

In 2012, the Forest Service carried out the first steps of a Bighorn Sheep Viability Analysis, identifying and mapping areas where occupied bighorn sheep habitat and domestic grazing allotments occurred on National Forest System lands (Weldon 2012). These maps, updated annually, display for each state both active and vacant domestic sheep and goat grazing allotments, along with occupied bighorn sheep habitat (Wild Sheep Working Group 2012b). There are no domestic sheep allotments on the Custer Gallatin National Forest. However, there are hobby sheep farms very close to the forest boundary in some areas, which make it difficult to keep effective separation.

Key Benefits to People

Intact and accessible bighorn sheep populations on public land provide the obvious recreation benefits for hunting and viewing wildlife, and also tribal and cultural values (these addressed elsewhere), but also provide for maintaining an intact predator community on public land in that many key predators (e.g., grizzly bears, black bears, cougars, wolves) utilize or scavenge live and dead bighorn sheep as prey.

Other key benefits of bighorn sheep include the economic opportunity for wildlife-based employment for outfitters and guides and biologists in the private sector and for biologists that work for state and Federal agencies. Bighorn sheep also provide for student research at academic institutions such as Montana State University.

Trends and Drivers

A century ago the numbers and distribution of ungulates native to Montana were at all-time lows due to over-harvest, degradation of habitat, and a lack of science-based management. Regulation of harvest, habitat protection and enhancement, and translocation programs have resulted in successful restoration of most ungulate species such as elk, mule deer, white-tailed deer, and pronghorn. While similar management and conservation efforts have been devoted to bighorn sheep, generally (statewide) the trend is increasing isolation between bighorn sheep herds and decreasing populations due to disease events which are initiated through transmission from domestic sheep and goats.

Isolation results in decreased genetic exchange and therefore decreased genetic diversity and adaptive capability. Sympatric distribution with mountain goats (which are not native east of the Continental Divide) may also affect bighorn sheep habitat use and goats may be vectors of lethal disease pathogens. Competition for forage on winter ranges shared by other ungulates or grazed by domestic livestock may affect the way bighorn sheep use the landscape. Hunter harvest is very conservation and controlled and therefore unlikely to be a driver for this species. Habitat quantity does not seem to be a driver. Climate change could serve to improve bighorn sheep habitat if there is a longer growing season, and also to maintain openings around escape terrain if fire plays a bigger role in the future. However, increased fire could also exacerbate the issue with invasive plants, particularly on bighorn sheep winter habitat. Bighorn sheep inhabit a wide range of climates, suggesting that any effects of climate change will not be uniform across Montana and possibly not even within eco-regions (Garrott et al. 2015).

Information Needs

The Montana State-wide Bighorn Initiative is a collaboration between Montana Fish, Wildlife & Parks and Montana State University focused on developing a long-term research study to better understand the ecology of Montana's bighorn sheep herds and enhance their management. They have begun to collect information from a sample of Montana's herds that have diverse disease history, health, and regional climate regimes to assess the role of herd attributes, annual variation in climate, disease pathogens, and habitat conditions on recruitment, adult survival, and population dynamics (http://www.mtbighorninitiative.com/mtbi-science.html). This along with the mountain ungulate project, will provide a more solid basis on which managers, both Montana Fish, Wildlife & Parks and land managers, can move forward in a positive direction to maintain healthy sheep populations on the landscape. Research on domestic sheep and goats to find out more about the prevalence and nutritional relationships of these pathogens in domestics may help find a solution that ultimately would benefit wild sheep.

Key Findings

Bighorn sheep are found mostly in portions of the Montane habitats of the Custer Gallatin National Forest. Habitat for bighorn sheep populations is found in 12 areas of the Custer Gallatin National Forest, many of which are in the Upper Yellowstone Complex north of Yellowstone National Park. Many of the sheep herds on the Custer Gallatin National Forest are native and not the result of transplanted sheep. Population trends are variable among the herds as is frequency of disease events and die-offs. Habitat management issues include invasive plants, proximity to domestic sheep and goats, proximity to mountain goats, human development, highway mortality, and snowmobile encroachment onto unique high elevation winter ranges.

Mountain Goats

Existing Condition

Population

Mountain goats occur only in western North America, in Montana, Idaho, and Washington and extending northward in Alberta, through British Columbia and into Yukon, Northwest Territories, and southeast Alaska. Mountain goats in Montana occur naturally west of and along the Continental Divide, with some introduced populations in central and southwestern Montana (Figure 14). In the plan area, mountain goats are not native, but the result of transplants from 30 to 70 years ago in seven locations. They are found in the Greater Yellowstone Mountain Ranges (Absaroka and Beartooth, Gallatin, Madison) as well as in the Crazy and Bridger Mountains. Montana’s goat population is one of the healthiest in the lower 48, and these animals are prized for wildlife viewing and for highly coveted goat hunting permits. The management of mountain goats is largely the authority of state wildlife management agencies which, for the plan area is Montana Fish, Wildlife & Parks.

Mountain goats are sensitive to disturbances and because they have low productivity, they are also sensitive to overharvest, with hunting tending to be additive and not compensatory (Montana Natural Heritage Program Field Guide). They have one of the highest natural mortality rates among big game animals due to the dangerous terrain and hostile climate in which they live (Chadwick 1973). They breed in November and December and nannies give birth to usually one kid in May or June. If a goat survives the juvenile years, longevity is normally 10 to 13 years. Both males and females have shiny black horns which are not shed, but grow annually. Males tend to be solitary and females with young are often found in small groups (Montana Natural Heritage Program Field Guide).

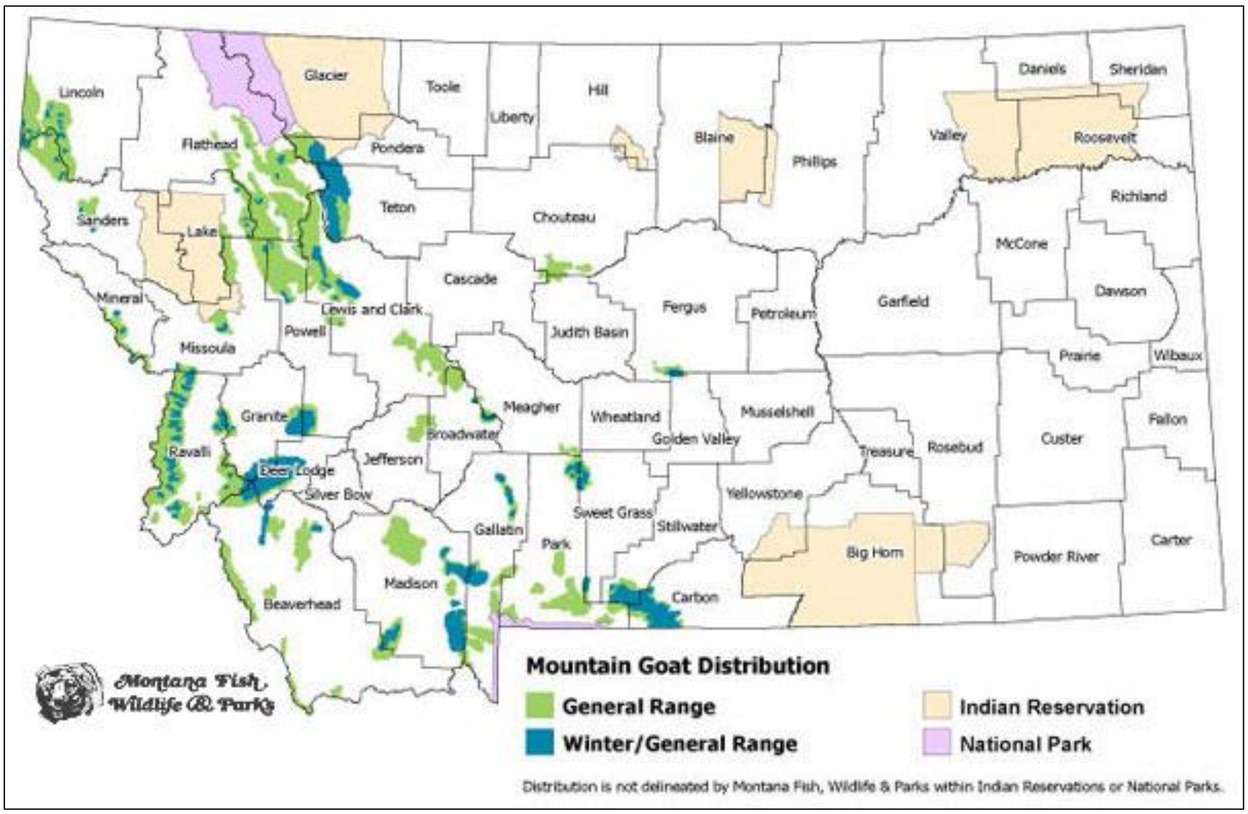

Figure 14. Distribution of mountain goats in Montana

Although mountain goats appear to be stable or even increasing in the Greater Yellowstone Area, they are disappearing in parts of their historic range. Since 1994, Montana Fish, Wildlife & Parks has closed nearly 20 percent of mountain goat hunting districts due to low numbers (Koeth 2008). Some biologists speculate that expanded snowmobile use at higher altitudes could factor in the decline, as well as climate warming, which could also contribute by changing or decreasing the amount of alpine habitat.

In addition, mountain goats are difficult and expensive to survey because their habitat is in rugged, difficult to reach terrain, but also because goats do not gather in large herds like deer or elk (Koeth 2008). The counts do not indicate exact populations, only indices. By comparing numbers with previous years, biologists can spot population trends and determine if herds are increasing, decreasing, or stable.

Recent work by Montana State University, looking at historical and contemporary survey data and by developing an occupancy survey technique, has resulted in an estimate of the mountain goats in the Greater Yellowstone Area. The minimum population estimate is 1,648 with a 2014 estimate of 2,355 goats, with 964 found west or north of Yellowstone National Park in the plan area (Flesch et al. 2016). Flesch et al. (2016) found the strongest growth rates in areas more recently colonized by mountain goats compared to goats with longer residency periods. Characteristics of mountain goat populations for the Custer Gallatin National Forest are detailed in Table 12 and Table 13. This data summary was derived from Montana Fish, Wildlife & Parks survey reports, Flesch and Garrott (2011), and Flesch et al. (2016)

Madison, Henrys, Gallatin and Absaroka Beartooth Mountains

Table 12. Mountain goat population and herd characteristics for the Greater Yellowstone Area portion of the Custer Gallatin National Forest

Mountain Goat area	Hunting District; # Permits	Population Average for the Last 5 Counts[1]	Kids/100 Adults; Estimated Population Trend[2]
Absaroka Mountains	323; 38 permits	146	33; stable to increasing
Absaroka Mountains	330; 3 permits	31	23; stable
Absaroka Mountains	329; 25 permits	120	29; stable
Beartooth Mountains	514, 517, 518, 519; 10 permits	82	25; stable or declining (Stewart unpublished report)
Beartooth Mountains	316; 12 permits	90	31; stable to increasing
Gallatin Mountains	314; 20 permits	86	39; stable or declining
Madison–Taylor Hilgards Range	325, 326, 327, 362, 328; 16 permits	86	10-27; stable or declining (Cunningham unpublished data)
Spanish Peaks	324; 6 permits	64	24; stable to increasing (Cunningham unpublished data)

[1] As reported by Flesch and Garrott.

2 As reported in Flesch et al. based on lambda coefficients or Montana Fish, Wildlife & Parks trend count data.

Bridger, Bangtail, and Crazy Mountains

Table 13. Mountain goat population and herd characteristics for the Bridger and Crazy Mountains areas of the Custer Gallatin National Forest

Mountain Goat area	Hunting District	Population Best Estimate	Kids/100 Adults; Estimated Population Trend
Bridger Mountains	393; 5 permits	Around 50 (surveys sporadic and under different conditions)	Ranged from 27–38 kids per 100 adults; trend unknown
Crazy Mountains	313; 55 permits	356 (average over 3 surveys done in 2009, 2011, and 2013)	Stable

According to the Montana Fish, Wildlife & Parks survey report (Loveless, K.), "Mountain goats were introduced into the Crazy Mountains in 1941 (10 goats) and 1943 (11 goats) from the Sun River. The population experienced a dramatic increase in the 1950s reaching an observed population of 342 goats in 1957. The Crazy Mountains were one of the most densely populated goat habitats in North America at that time. The goat population declined rapidly in the late 1950s and early 1960s. Goat hunting was greatly restricted and eventually closed in 1976. This “boom and bust” population trend has been observed in other introduced mountain goat populations as well. The reasons for differences in population trends between introduced and native populations are not fully understood. In introduced populations there appears to be a much higher reproductive rate and goat populations can increase beyond ecological carrying capacity, resulting in a population crash. After the Crazy Mountain goat population crashed in the early 1960s, there was a period of nearly 30 years where goat numbers remained very low before numbers began increasing again.”

Mountain goat numbers in the Crazy Mountains increased from lows of less than 50 observed from the mid-1970s through the 1980s to a peak of 371 observed in 2011. Limited goat hunting resumed in 1990. Goat survey numbers have increased dramatically since 1990, from 60 to 371 goats. Since 1990, when goat numbers began to rebound, reproductive ratios have ranged from 18 to 37 kids/100 adults. During peak populations in the early 1950s, recruitment ranged from 30 to 38 kids/100 older goats (mean=35 kids/100). The 2011 survey of 371 goats is the highest count ever recorded in the Crazy Mountains, and possibly the most goats ever counted in a single survey area in Montana.

When hunting was resumed in 1990 the management goal was to: (1) annually harvest 10 to 15 percent of the observed "older goats" in the population, (2) keep the total observed population below 300 animals, and (3) maintain recruitment rates of 20 to 30 kids/100 older goats in our observed sample. This approach is generally a more liberal management approach than is taken for most mountain goat populations, particularly as compared to native goat populations. In spite of the liberal harvest, the population has continued to increase and kid:older goat ratios have remained at or above the recruitment objective.

Habitat

Goats select home ranges based on forage availability, good visibility to avoid predators, cooler microclimates for thermoregulation in summer, and may selectively partition habitat shared with competitors such as bighorn sheep (DeVoe et al. 2015). The alpine habitats used by goats have the important foraging species that include grasses, sedges, lichens, forbs and shrubs. The dominant food items vary dependent on range and season. Winter and summer ranges often strongly overlap, with goats changing aspect or elevation to feed on forage exposed by wind in winter or on very steep slopes where snow does not accumulate (Foresman 2012). Although mountain goat and bighorn sheep ranges overlap in the Greater Yellowstone Area (sympatric), mountain goats and bighorn sheep may have separate ecological niches that overlap only marginally especially on summer range and in situations where sympatric populations have had enough time to adapt (DeVoe et al. 2015). Goats may travel several miles to use natural salt licks or those used by domestic livestock. This is due to their requirement for sodium in summer and fall which they do not get in from their forage (Foresman 2012).

DeVoe et al. (2015) developed resource selection models based on goat observation data in the Greater Yellowstone Area over 3 years. They found that mean slope and slope variance at a 500-meter scale, and not distance to escape terrain, were important predictors of goat habitat selection at a coarse scale. Goats also selected areas with rugged topography and rock outcrops. At a finer scale (100 meter), goats selected areas with lower canopy cover, areas of topographic shading or lower heat loading, and areas of good nutrition (NDVI or normalized difference vegetation index). They used this model to predict suitable mountain goat habitat over the entire Greater Yellowstone Area and estimated that there was over2 million acres (9,035 square kilometers) of habitat (18 percent of the Greater Yellowstone Area) with at least low suitability. About 1.5 million acres (6,131 square kilometers) of this is currently not occupied. Based on current mountain goat densities, they estimated that over 5,000 goats could be supported in the northern Greater Yellowstone Area. The current population estimate for the West and

North Greater Yellowstone Area is 964 goats (Flesch et al. 2016). Flesch et al. (2016) found that goats had dispersed from transplanted populations over 50 kilometers to occupy all the mountain ranges in the northern Greater Yellowstone Area and that this dispersal included movements through unsuitable mountain goat habitat. Based on their predictions then, the Greater Yellowstone Area may continue to be a stronghold for increasing non-native mountain goat populations, which could ultimately have a negative effect on native bighorn sheep if niche overlap results in competition for limited resources such as winter forage. Goats are also known to carry respiratory pathogens that are responsible for die-offs in bighorn sheep (Flesch et al. 2016).

Key Benefits to People

Intact and accessible mountain goat populations on public land provide recreation benefits for hunting and viewing wildlife, and also tribal and cultural values (these addressed elsewhere). Known predators include golden eagles and mountain lions, but they are not reliant on mountain goats for prey. Mountain goats may provide carrion for scavengers such as wolverine.

Other key benefits of mountain goats include the economic opportunity for wildlife based employment for outfitters and guides and biologists in the private sector and for biologists that work for state and federal agencies. Mountain goats also provide for student research at academic institutions such as Montana State University.

Trends and Drivers

Mountain goat populations and distribution are limited by the amount and distribution of high elevation habitat that includes rugged rocky terrain. Because of their ecological niche, they have high natural mortality rates due to things like avalanches and falling accidents. Predators do not seem to be a key driver in the niche they occupy. Climate change could have the effect of reducing alpine habitat if trees colonize alpine meadows, and to reduce forage quality and quantity by earlier snowmelt, which keeps alpine plants succulent throughout the summer. Harvest of mountain goats, thought to be additive, is also a driver. However, Montana’s quotas tend to be conservative. Expansion of hunting could be used to keep mountain goat populations at low densities where bighorn sheep are a priority. Human disturbances, such as snowmobiling during winter and spring months when goats have depleted nearly all their fat reserves could have implications on the distribution and abundance of mountain goats (Koeth 2008).

Information Needs

With a better understanding of the ecology of Montana's bighorn sheep herds, management of mountain goats and mountain ungulate habitat may be forthcoming. In addition, data on the effects of climate change on the alpine community are needed to predict secondary effects to mountain ungulates. There are areas in mountain where native mountain goat populations are declining and it could be informational to have a better understanding of what is affecting goats in those areas so that preemptive management in areas such as the Greater Yellowstone Area, where goats seem to be thriving, could be applied if appropriate.

Key Findings

Mountain goats are found in the Greater Yellowstone Area ranges as well as the Bridger and Crazy Mountains on the Custer Gallatin National Forest. They are not native, but the result of transplants 30 to 70 years ago. Goats in some places of Montana are declining, but overall seem secure and even increasing in the Greater Yellowstone Area and Bridger and Crazy Mountains. Goats have the potential to impact native bighorn sheep through competition and disease transmission. The alpine habitat favored by mountain goats may be reduced in quantity and quality with climate change. Snowmobile encroachment into mountain goat habitat may have negative effects on their ability to fully use habitat, which is already naturally limited.

Bison

Existing Condition

Background

Management of Yellowstone Park bison comes under the Interagency Bison Management Plan. The current record of decision was signed in 2000 and included the Forest Service as a signatory. The National Park Service and Montana Department of Fish, Wildlife and Parks have started working on a new Interagency Bison Management Plan and the Custer Gallatin National Forest will participate as a cooperating agency since there is no Forest Service action proposed. All documents associated with the Interagency Bison Management Plan are on www.ibmp.info.

Yellowstone bison spend most of the year inside the boundary of Yellowstone National Park in two herds (northern and central). However, bison are a migratory species and move across a vast landscape in search of food. During most winters, when food is often limited by deep snow, some bison from the northern herd migrate into the Gardiner Basin north of Yellowstone National Park. Some bison in the central herd migrate west of Yellowstone National Park into the Hebgen Basin near the town of West Yellowstone. These two basins include portions of the Custer Gallatin National Forest. The Custer Gallatin National Forest is the only national forest occupied by wild bison for a portion of the year.

Under the Interagency Bison Management Plan, some bison are allowed to migrate out of Yellowstone National Park during the late fall, winter and early spring. The timing and numbers of bison migration is a function of weather related variables, in particular, snow conditions inside the park. This use is generally near the park boundaries on the Gardiner and Hebgen Lake Ranger Districts on the Custer Gallatin National Forest (Figure 15). Bison numbers and their distribution in Montana are managed under the authority and discretion of the state veterinarian due to their chronic exposure to brucellosis (81-2-120 Montana Code Annotated 2011 cited by White et al. 2015). The Montana Department of Livestock has the lead responsibility for all bison management actions and may request assistance from Montana Fish, Wildlife & Parks; the Forest Service; Animal Plant and Health Inspection Service; and the National Park Service. Within Yellowstone National Park boundaries, the Park Service is responsible for all bison management actions.

The only known focus of *Brucella abortus* infection left in the Nation is in bison and elk in the Greater Yellowstone Area (Aune et al. 2012). While bison can transmit brucellosis to cattle, all known transmissions in the Greater Yellowstone Area have been traced to elk and not bison (Ryan et al. 2013; Kamath et al. 2016). Bull bison pose almost no risk of transmission to cattle since the means of transmission is from aborted fetal tissue and fluids. Aune et al. (2012) found that Brucella bacteria can persist on fetal tissues and soil or vegetation for 21 to 81 days depending on month, temperature, and exposure to sunlight, but did not survive on tissues beyond June 10 due to the effects of UV and temperature. Scavengers were also an important factor in the disappearance of fetal tissue. They concluded that temporal separation of bison and cattle on shared pastures was an effective means of managing the risk of transmission.

Bison have been hunted on Custer Gallatin National Forest lands outside Yellowstone National Park by tribal and state-licensed hunters since 2005 (state hunting also occurred prior to 1991). To date, hunting has not resulted in reduction of bison to the target population (3,000 per the 2000 Interagency Bison Management Plan); therefore, Yellowstone National Park has continued to trap bison at the Park Boundary. Yellowstone National Park is expected to make a decision on its quarantine analysis in the near future (transferring bison to approved facilities); this would be an alternative to shipping trapped bison to slaughter. Meat from bison shipped to slaughter (Table 14) is provided to Native American tribes.

The Custer Gallatin National Forest's involvement in management of bison is primarily through participation in the Interagency Bison Management Plan. There are three permitted activities associated with Custer Gallatin National Forest lands relative to bison. These include a permit for a portable temporary trapping facility on Horse Butte (issued in 1999 and renewed for 10 years in 2009, which was used 5 of the first 10 years and not since), a permit for Montana Fish, Wildlife & Parks to construct and maintain a fence associated with the bison guard at Yankee Jim Canyon, and most currently and in progress, a permit to construct and maintain a fence (Montana Department of Highways) associated with the bison guard on Highway 287 near Hebgen Dam.

The Custer Gallatin National Forest considers bison to be a wild ungulate when they occupy National Forest System lands. Although there have a few active livestock allotments within the area where bison are tolerated on the national forest (Source: Interagency Bison Management Plan annual reports.

), the Custer Gallatin National Forest expressed position is that it can manage livestock allotments (e.g., adjust class of livestock, cattle turn-on dates, or closures) to provide adequate spatial and temporal separation, relative to bison and brucellosis, to ensure allotments are not a barrier to existing or expanded tolerance.

In December 2015, Montana Governor Steve Bullock signed a decision notice that expanded tolerance for bison, primarily west of Yellowstone National Park. As part of this effort, tolerance zones were identified as areas where bison are allowed; i.e., not harassed or hazed, outside of Yellowstone National Park (Figure 16). The decision was based on an environmental assessment completed by Montana Fish, Wildlife & Parks under the Montana Environmental Policy Act (Montana Fish, Wildlife & Parks 2014). The decision allows year-long access to certain areas west of Yellowstone National Park (excludes access to areas with intermingled private lands) for both cows and bulls. It allows year-long access in the Gardiner Basin, north of Yellowstone National Park for bull bison only.

At its April 6th meeting, the Interagency Bison Management Plan partners endorsed the Governor's decision and outlined the needed changes an adaptive management plan that would implement the decision. That modified plan was signed by the partners under the Interagency Bison Management Plan.

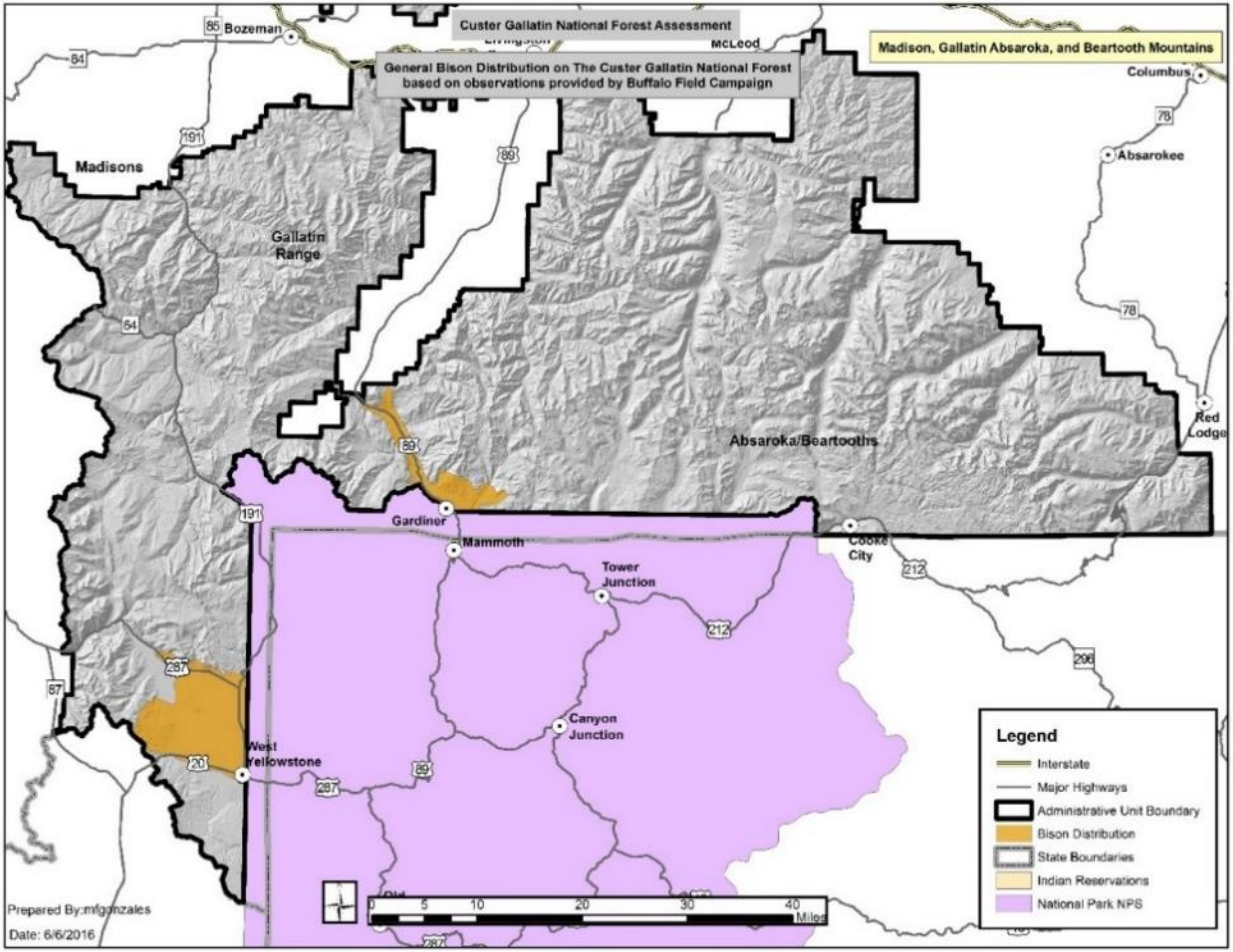

Figure 15. Distribution of bison in winter-spring on the Custer Gallatin National Forest based on Buffalo Field Campaign observations

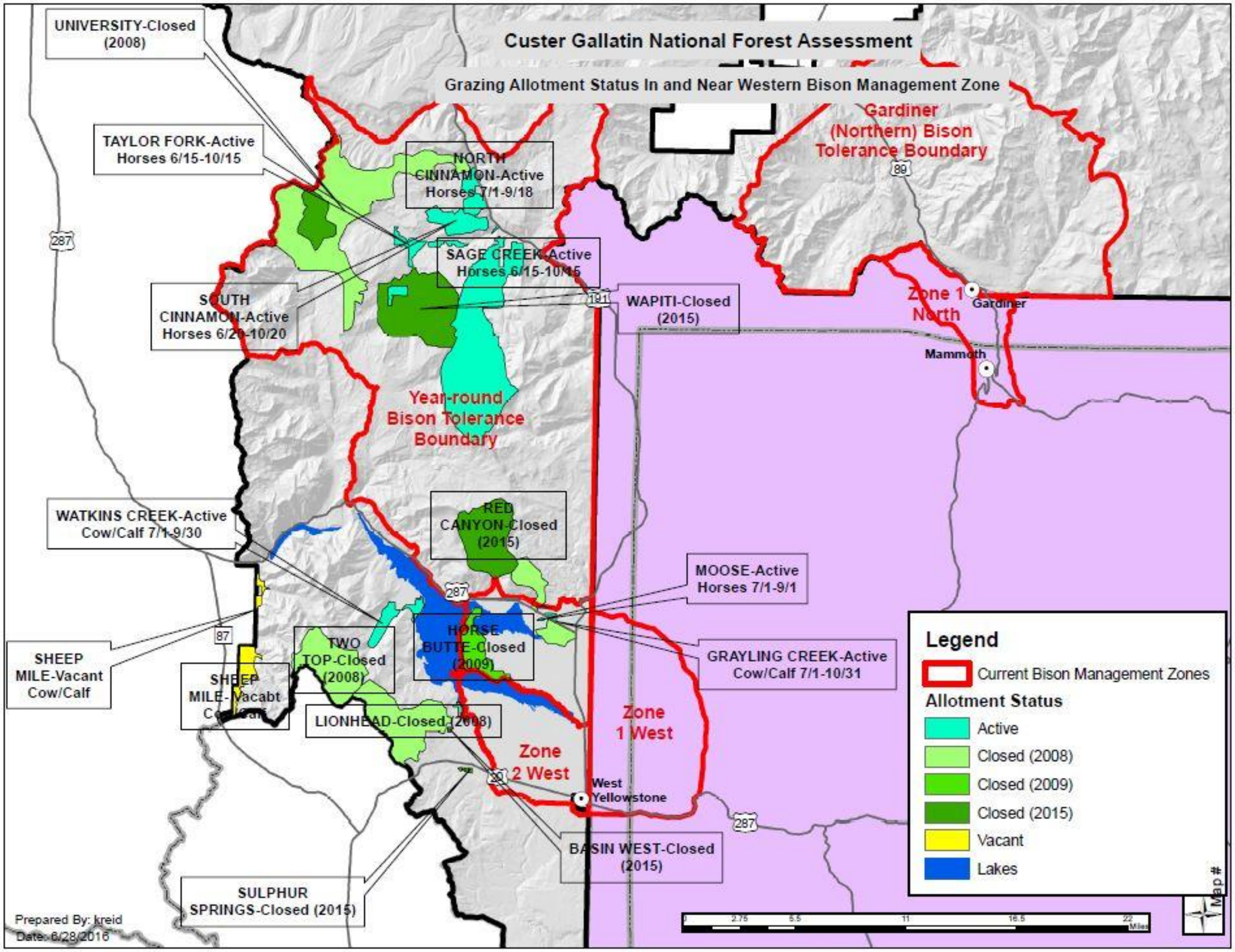

Figure 16. Bison tolerance zones and livestock grazing allotment status in 2016

Table 14. Bison management from 2008 through 2016

Year	Bison Shipped to Slaughter or Management Culls	Hunter Harvest	Sent To Quarantine
2016	50	380	?
2015	507	145	7
2014	258	322	60
2013	0	229	0
2012	0	28	0
2011	6	260	53
2010	3	4	0
2009	4	1	0
2008	1,448	166	112

Source: Interagency Bison Management Plan annual reports.

Table 15. Domestic livestock allotments within or nearby Bison Management Zones

Allotment Name	Location	Status	Class and Number of Livestock	Permitted Season
Allotments Within Western Bison Zone 2, Hebgen Ranger District				
Moose	East of Hebgen Lake	Active	4 horses	7/1–9/1
Grayling Creek	East of Hebgen Lake	Active	24 horses	7/1–10/31
Horse Butte	East of Hebgen Lake	Closed (2009)	Previously, cow/calf pairs	
Duck Creek	East of Hebgen Lake	Closed (2008)	Previously, cow/calf pairs	
Dry Gulch	Northeast of Horse Butte, North of Highway 287	Closed (2008)	Previously, cow/calf pairs	
Allotments Within the Western Bison Yearlong Tolerance Zone, Hebgen Ranger District				
Sage Creek	Taylor Fork Area	Active	129 horses	6/15–10/15
North Cinnamon	Taylor Fork Area	Active	60 horses	7/1–9/18
South Cinnamon	Taylor Fork Area	Active	35 horses	6/20–10/20
Taylor Fork	Taylor Fork Area	Active	90 horses	6/15–10/15
Wapiti	Taylor Fork Area	Closed (2015)	Previously, 160 cow/calf pairs	
Cache-Eldridge	Taylor Fork Area	Closed (2015)	Previously, 154 cow/calf pairs	
University	Taylor Fork Area	Closed (2008)	Previously sheep	
Red Canyon	North of Horse Butte, North of Highway 287	Closed (2015)	Previously, cow/calf pairs	
Allotments Outside of but Near the Western Bison Management Zones				
Watkins Creek	West of Hebgen Lake	Active	55 cow/calf pairs	7/1–9/30
South Fork	South of Hebgen Lake	Active	15 cow/calf pairs	7/1–9/30
Sheep Mile	South of Quake Lake	Vacant (Forage Reserve Allotment)	Previously, 89 yearlings	Previously, 6/20–10/20

Allotment Name	Location	Status	Class and Number of Livestock	Permitted Season
Basin	South of Hebgen Lake	Closed - West Unit (2015)[1]	Previously, 10 cow/calf pairs	
Sulphur Springs	South of Hebgen lake and Highway 20	Closed (2015)	Previously, 10 horses	
Lionhead	Hebgen Lake Area	Closed (2008)	Previously sheep	
Two Top	Hebgen Lake Area	Closed (2008)	Previously sheep	
Allotments within the Northern Bison Management Zone, Gardiner Ranger District				
Slip and Slide	East of Yellowstone River	Active	110 cow/calf pairs	6/16–10/15
Green Lake	West of Yellowstone River	Active	46 cow/calf pairs	6/16–10/15
Cottonwood	West of Yellowstone River	Vacant	Previously, cow/calf pairs	
Lion Creek	West of Yellowstone River	Vacant	Previously, cow/calf pairs	
Mill Creek & Section 22	Upper Cinnabar and Upper Mulherin	Vacant	Previously, 36 cow/calf pairs	Previously, 6/16–10/15
Park	West of Yellowstone River	Closed (2007)	Previously, cow/calf pairs	
Sentinel Butte	East of Yellowstone River	Closed (2007)	Previously, cow/calf pairs	
Allotments Outside of but Near the Northern Bison Management Zone, Gardiner Ranger District				
Tom Miner and Ramshorn	Tom Miner Basin	Active	126 cow/calf pairs; and private land 134 cow/calf pairs	7/1–10/15
Horse Creek/Reeder Creek	Upper Tom Miner	Active	81 cow/calf pairs, 22 yearlings, and 15 horse; and private land 15 horses	7/1–9/30
Wigwam	Lower Tom Miner	Active	56 cow/calf pairs; and Private Land 20 cow/calf pairs	6/16–9/30
Canyon	Tom Miner Basin	Closed (2007)	Previously, cow/calf pairs	

[1] East Unit added to the Basin Admin Site for periodic government stock use (horse/mule).

Population

The last wild plains bison herd in existence occurred in the Yellowstone area. Modern Yellowstone bison are their descendants (although 25 bison from Texas and Montana were brought in to augment the population in 1902). This is the only plains bison herd to continuously occupy part of its historic range. Genetically pure wild bison occur at greatly reduced numbers across a very small fraction of their historical pre-European settlement range despite current and past conservation efforts (White et al. 2015).

Bison are common in domestic herds, but may not be subject to the same selective pressures as wild bison. There may be artificial genetic selection for morphological, behavioral, and physiological traits different than those selected for in the wild, and substantial differences can arise in a few generations. Genetic studies have found domestic cattle DNA introgression in the vast majority of domestic and conservation herds studied to date. The Yellowstone herd is one of the few where this has not been detected. Yellowstone bison exhibit wild behaviors and roam relatively freely over a large landscape (White et al. 2015).

Bison are social and gregarious and often form small herds of female led groups of about 20 animals. Cows and young remain in herds throughout the year, whereas bulls are solitary or in small groups until the rutting season in the summer when they begin to mix with cow-calf herds.

Most cows breed at 2 to 4 years, whereas males usually mature at 3 years; however, older (6+ years) males do most of the breeding. Breeding occurs in July and August, with gestation lasting 9.5 months. Normally, 1 calf is born mid-April to early June, with most births occurring in May. Cows usually give birth in isolation where vegetation provides cover. Brucellosis causes abortion and temporary sterility in cattle, but does not affect pregnancy rates In Yellowstone bison to any significant degree. Most calves are weaned by the end of their first year but remain with their mother until spring or later if she does not conceive. The life span of a Bison is 18 to 22 years. Winterkill is the primary mortality factor in Yellowstone Park. More severe winters result in increased winterkill. Wolf predation of bison has increased since their reintroduction into Yellowstone National Park (White et al. 2015).

Since near extinction over a century ago, Yellowstone bison populations have steadily increased and since 2000 have ranged from about 2,500 to just under 5,000 animals (Figure 17). The Interagency Bison Management Plan objective is 3,000. In winter 2016, there were about 5,000 bison counted following a removal of about 580 animals by state and tribal hunters and management culling (Interagency Bison Management Plan records).

Plumb et al. (2009) concluded that in light of severe winters and in balancing the capacity of the forage base in Yellowstone National Park, maintaining genetic diversity, and preserving migratory behavior, a population of 2,500 to 4,500 bison is sustainable, but at current high populations, it is difficult to effectively reverse the positive population trend. In light of social tolerance issues, the prevention of further dispersal and range expansion, hunting and culling operations would be need to be used to manage populations.

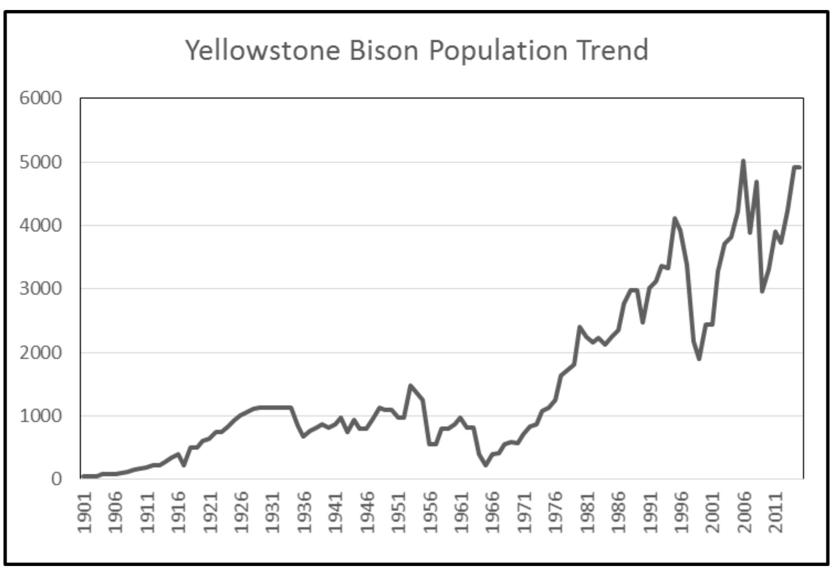

Figure 17. Population trends in Yellowstone bison

Source: The National Parks Conservation Association.

Habitat

Bison historically occupied about 20,000 square kilometers (4,942,108 acres) in the headwaters of the Yellowstone and Madison Rivers (Plumb et al. 2009). As of 2008, they occupied 3,175 square kilometers (784,560 acres) predominantly inside Yellowstone National Park. The current tolerance areas include about 200,000 acres on the west side and about 105,000 acres in Gardiner Basin on the north side. Prior to the Governor's decision, the tolerance zones were 12,500 acres on the north and about 70,000 acres to the west.

Bison select for mesic grassland habitats (Schoenecker et al. 2015) and graze on grasses, forbs, and sedges. In the winter, they use their massive heads to scoop snow away from forage. In Yellowstone National Park, sedges are most important in all seasons, followed by grasses. Forbs and browse are minor components in the diet (Meagher 1973). Although their food intake is large (about 30 pounds per individual per day), in a study in Utah, Ranglack et al. (2015) found that utilization of rangeland averaged 14 percent by bison, 52 percent by domestic cattle, and 34 percent by jackrabbits. During the winter, about a third of the foraging time is used to displace snow, which reduces foraging efficiency (Plumb et al. 2009). Since the 1980s, there has been migratory movements of bison outside the park in response to harsh winter conditions that make foraging difficult. This behavior, if not curtailed by intensive management actions, would likely have resulted in continued expansion of winter range and dispersal to suitable habitats north and west of the park (Plumb et al. 2009). Plumb et al. noted that population levels of about 550 and 1,500 for the northern and central herds, respectively, trigger migration outside of the park. There has also been movement from the central herd to the northern herd in part due to milder winter conditions and population levels in the central herd. The thermal features that bison use in Hayden Valley do not produce the same quality or quantity of forage relative to the northern range (White et al. 2015).

When bison leave Yellowstone National Park in the late fall and winter, they use habitat managed by the Custer Gallatin National Forest as well as private lands if they are tolerated. The reverse pattern occurs in the spring as snow melts and bison follow new vegetation growth from lower to higher elevations. The onset of new vegetation growth typically begins 3 weeks earlier in northern Yellowstone than in central Yellowstone such that bison on the Custer Gallatin National Forest near West Yellowstone tend to arrive later but be on the National Forest longer than bison on the northern range near Gardiner. Most bison migration into Montana occurs in late February and March across the northern boundary, and in April and May across the western boundary (White et al. 2015). Relatively few bison exit the northern boundary when conditions are mild. Bison migration back to interior park ranges typically occurs during April through June. At the present time, under the increased tolerance decision, this timing is also influenced by hazing operations forcing (female) bison back into Yellowstone National Park by May 1 on the northern range. Bison movements in areas of no tolerance are controlled by strategically placed "bison guards" on the highways which block movement of bison on the northern range from entering Yankee Jim Canyon on U.S. Highway 89 and from leaving the Hebgen Basin to the west on U.S. Highway 287 near Hebgen Dam. Bison are also hazed from areas of no tolerance such as private lands in the Hebgen Basin and areas south of the Madison River.

On the west side, in the absence of hazing from Horse Butte (this is first spring that the haze has not occurred), bison distribution and abundance in Hebgen Basin was monitored by Forest Service personnel. In May, bison numbers were around 250 in the basin and as of June 27, there were only 10 bison observed. About that many bison remained by the end of July. It appears that bison naturally migrate back into the park in mid-late May as conditions in the park provide green forage.

The key role of the Custer Gallatin National Forest relative to bison is to provide suitable habitat. Based on recommendations from Yellowstone National Park bison biologist Rick Wallen about bison habitat use (Wallen, R., 2016, personal communication), a query of existing vegetation (R1VMAP) was completed that included elevations below 9,000 feet, in grass, shrub, and low tree canopy cover (less than 25 percent) dominance types. Wallen noted that bison use all slopes (relative to steepness and aspect) and use some tree habitats, particularly in the fall. Given current constraints on bison tolerance, there is no expectation that bison would be re-established outside of the landscapes that are adjacent to Yellowstone National Park. Therefore, habitat was assessed only for the Madison, Gallatin and Beartooth landscape.

Currently, within the Madison, Gallatin, and Beartooth landscape, there are 293,151 acres (12.5 percent) of potentially suitable habitat for bison on the Custer Gallatin National Forest. Of that amount, 224,143 acres are grass and shrub lifeforms (Figure 18).

An on-going study of forage utilization and production in Lamar Valley of Yellowstone National Park has shown that bison grazing stimulates large amounts of soil nitrogen for plants leading to higher nitrogen availability in the food available for bison (Interagency Bison Management Plan Annual Report, 2015). Bison appear to be engineering their own habitat and enhancing the nutritional value by repeated grazing of sites throughout the growing season. Shifting patterns of bison use on the landscape are likely given forage changes, climate change, predation, and management actions.

The Custer Gallatin National Forest, in cooperation with Montana State University, undertook a habitat baseline study in Gardiner Basin in 2015 and this is on-going in 2016, with plans to replicate this type of analysis on Horse Butte in the Hebgen Basin in 2017 to 2018. The work included reconstructing historical conditions from past range studies and establishing soil and vegetation plots stratified by slope, aspect, elevation, lifeform, and geology (Figure 19). The objective of establishing the baseline is to be able to detect a 20 percent change in conditions with 80 percent accuracy. Data analysis from 2015 (Marlow, unpublished data) showed that range conditions are less than ideal, with most of the sites having 33 to 45 percent bare ground, which is between low-moderate erosion potential. The study also found that there is low species richness (19 species versus 65 suggested from the literature for this range type), which may be suggestive of low ecosystem resilience. However, no conclusions about trend are possible at this point, and it could be that the range condition is heading in a positive direction because of the reduction in elk foraging due to the dramatic decline in the Northern Range elk herd.

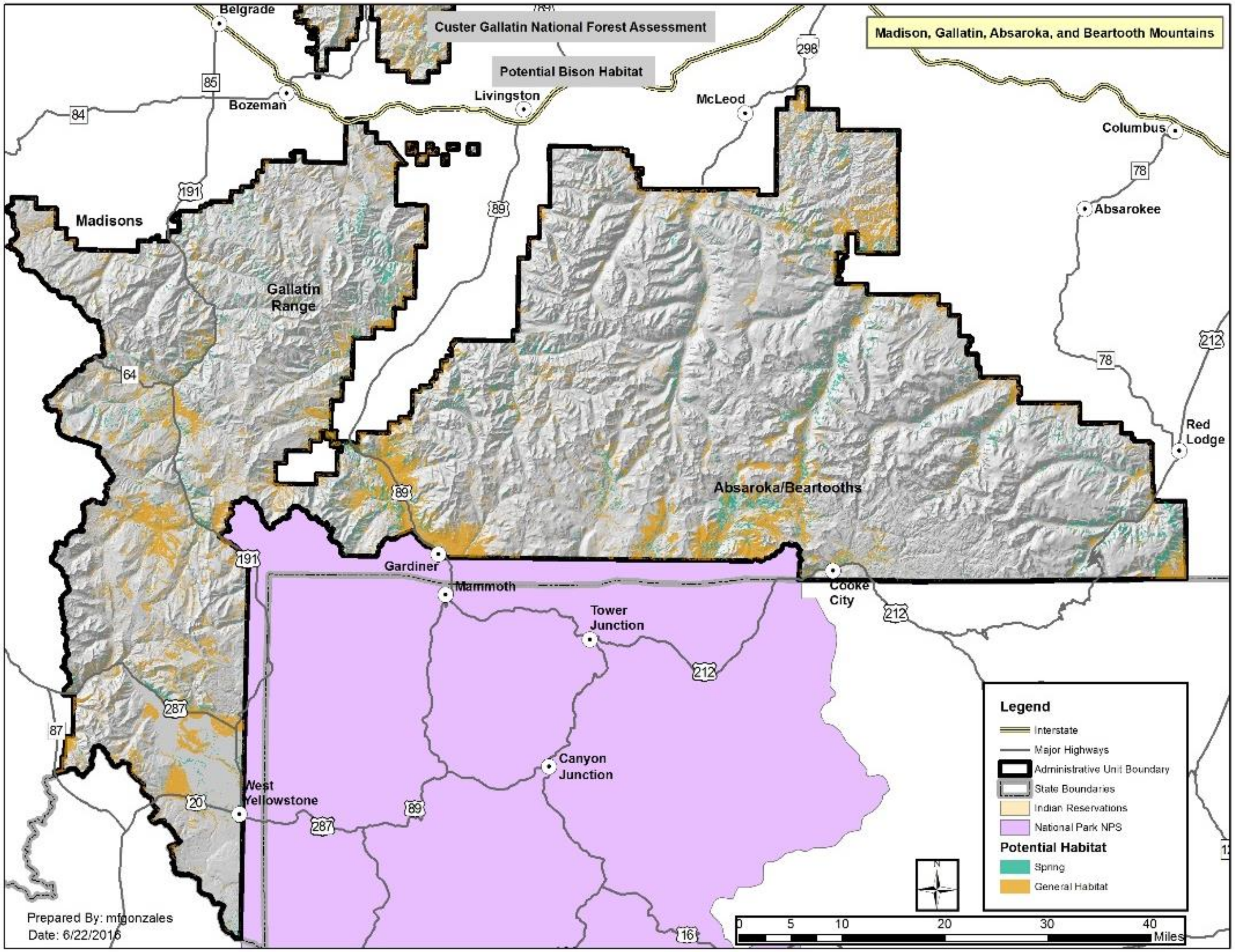

Figure 18. Potential bison habitat in the Madison, Gallatin, Absaroka, and Beartooth analysis area

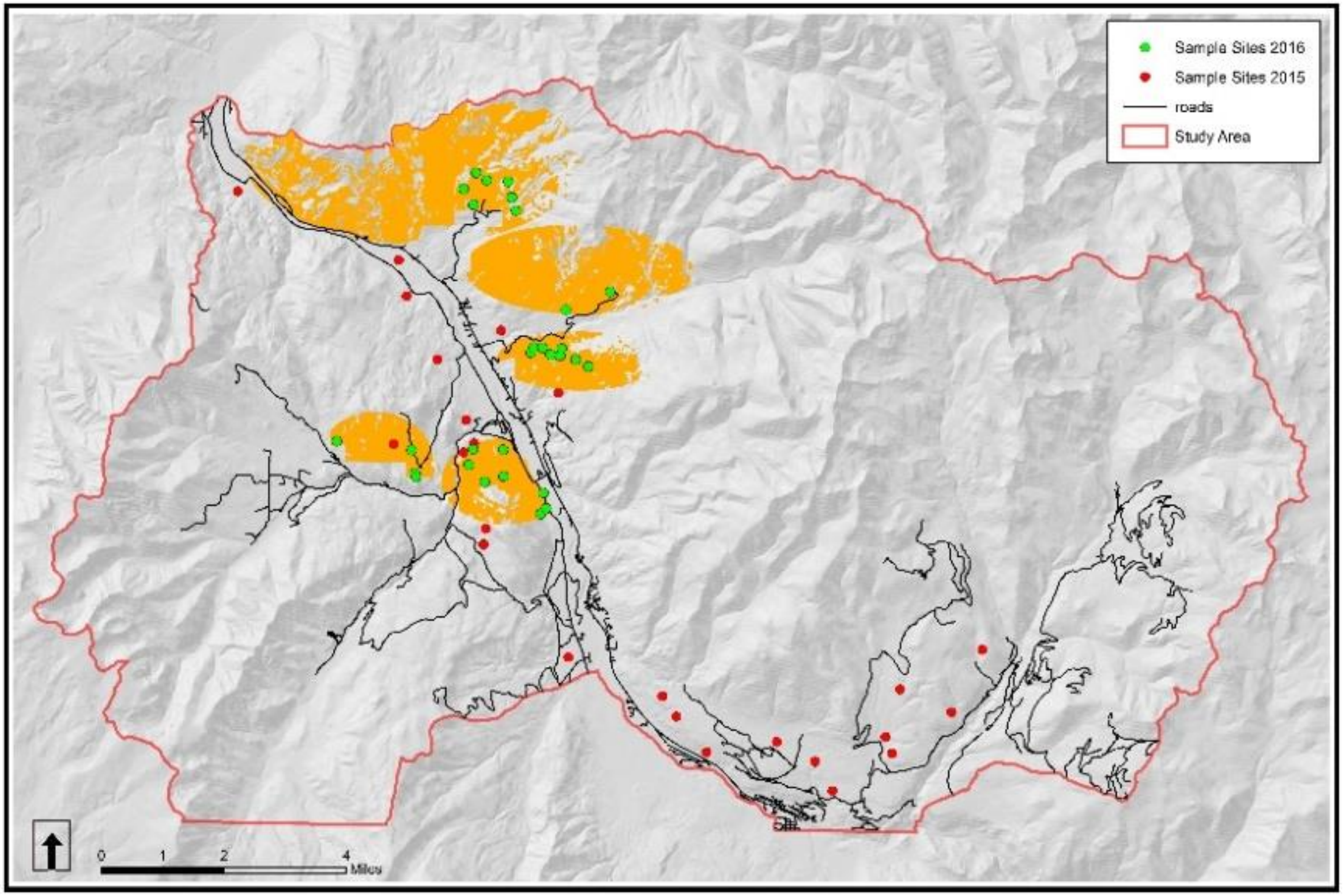

Figure 19. Plot locations for baseline habitat inventory in Gardiner Basin

The average useable forage production, based on 16 sites in the Gardiner Basin, was 586 pounds per acre. Given the droughty nature of this area, that is a very conservative figure to use in calculating forage availability on the entire Madison, Gallatin, and Absaroka Mountain Ranges. Nonetheless, with 224,143 acres of potentially suitable habitat in the Madison, Gallatin, and Absaroka Beartooth Mountain Ranges, the total conservatively estimated amount of forage production on those acres is 131,347,798 pounds. If only 10 percent of this was allocated to bison (given needs for other ungulates and domestic livestock), and each bison requires 930 pounds of forage in a month (31 pounds per day), then this portion of the Custer Gallatin National Forest could provide 14,123 bison months of grazing capacity. This equates to forage for 1,177 bison year-round or 2,354 bison for 6 months. Habitat improvements such as prescribed burning, aspen and meadow restoration, thinning and patch cuts in forest, and restoration of native grass species are all management actions that could increase this capacity. Yellowstone National Park bison biologist Rick Wallen (2016, personal communication) suggested that the NDVI index explained in the elk section, might also predict good habitat for bison (see Figure 11). Currently, a proposed land exchange (Shooting Star Ranch Land Exchange) is being analyzed which would provide an additonal 600 acres of publically owned habitat for bison in the Slip & Slide drainage in Gardiner Basin, if and when it becomes part of the Custer Gallatin National Forest.

Key Benefits to People

Yellowstone bison are a unique contribution to the rich biological and cultural values of the Greater Yellowstone Area. People travel from all over the globe to visit Yellowstone Park and to see wild bison. This has direct economic values to gateway communities and indirect values to humans from the experience of seeing wild bison in their native habitat.

Bison populations on public land provide recreation benefits for hunting and viewing wildlife, and also tribal and cultural values (these addressed elsewhere). Both state and tribal hunters harvest bison on the Custer Gallatin National Forest.

When they are allowed the opportunity to access large landscapes, bison are a keystone species; that is, they shape and influence the diversity of grassland ecosystems, and species that are inhabitants those grasslands (White et al. 2015). Some bird species require the short-grass conditions created by bison grazing (Askins 2007). Bison grazing and urine and feces contribute to increased plant nitrogen in areas grazed repeatedly. Bison may be important dispersers of grass and forb seeds. Known predators include wolves and grizzly bears, but they are not reliant on bison (a formidable prey species). However, bison carcasses, gut piles, and winter kill provide carrion for a host of carnivores and scavengers.

Other key benefits of bison include the economic opportunity for wildlife based employment for outfitters and guides and biologists in the private sector and for biologists that work for state and Federal agencies. Bison also provide for student research at academic institutions such as Montana State University.

Trends and Drivers

Yellowstone bison numbers have been steady increasing since near extinction a century ago. Bison are migratory and seek forage outside of Yellowstone National Park during the winter and spring. They naturally migrate north and west onto the Custer Gallatin National Forest especially in severe winters. The numbers on the Custer Gallatin National Forest are controlled by the State of Montana. A recent decision was made to allow bison in a larger area for a longer period of time on the west side. Bison on the forest are often re-distributed by hunting because hunting is concentrated along the boundary with Yellowstone National Park. Social tolerance for bison outside of the park is limited by the perceived risk of transmission of brucellosis to domestic cattle, when elk are the likely source of cattle infections. There has been a trend of decreased active allotments in areas near or within bison tolerance zones; however, the Custer Gallatin National Forest has other potential ways to minimize the risk of transmission of brucellosis from bison to cattle. The Custer Gallatin National Forest has capacity in terms of suitable habitat and forage for additional bison than is currently tolerated. Since bison are no longer hazed from Horse Butte, there is no need to renew the special use permit to Montana to use a temporary portable trap on Horse Butte. This permit is up in 2019. Bison habitat suitability in the future will be influenced by climate change and disturbance or the lack of disturbance. Grazing, including grazing by bison, reduces fine fuel accumulations and could be a tool for land managers to deal with the likely higher wildfire risk associated with climate change (Svejcar et al. 2013).

Information Needs

The Custer Gallatin National Forest is working with Montana State University to complete habitat baseline inventories for the Gardiner Basin and is making plans to replicate this type of work on the west side. This information will help inform managers about range conditions and range capacity for including bison as a species of wildlife that occupies the forest at least on a seasonal basis. In Gardiner Basin, there is a need to understand the timing and niche partitioning of the many ungulate species that use this key winter rangeland resource.

Key Findings

Yellowstone bison are at an all-time high population having nearly gone extinct a century ago. During most winters, when food is often limited by deep snow, some bison from the northern herd migrate into the Gardiner Basin north of Yellowstone National Park. Some bison in the central herd migrate west of Yellowstone National Park into the Hebgen Basin near the town of West Yellowstone. These two basins include portions of the Custer Gallatin National Forest. The Custer Gallatin National Forest is the only national forest occupied by wild bison for a portion of the year. The only known focus of *Brucella abortus* infection left in the Nation is in bison and elk in the Greater Yellowstone Area. While bison can transmit brucellosis to cattle, all known transmissions in the Greater Yellowstone Area have been traced to elk and not bison. An important function of the Custer Gallatin National Forest lands occupied by bison is to provide state and tribal hunters an area they can harvest a wild buffalo. Bison have been hunted on Custer Gallatin National Forest lands outside Yellowstone National Park by tribal and state-licensed hunters since 2005 (state hunting also occurred prior to 1991). To date, hunting has not resulted in reduction of bison to the target population (3,000 per the 2000 Interagency Bison Management Plan); therefore Yellowstone National Park has continued to trap bison at the park boundary. The Custer Gallatin National Forest issues a permit for a portable temporary trapping facility (operated by the state of Montana) on Horse Butte (issued in 1999 and renewed for 10 years in 2009), which was used 5 of the first 10 years and not since. With expanded tolerance for bison on the west side, this permit is no longer needed. On the Hebgen Lake Ranger District, there are two active horse allotments within Western Bison Zone 2, four active horse allotments within the Western Year-round Bison Tolerance Zone, and two active cow/calf pair allotments and one vacant cow/calf pair allotment outside of but near the Western Bison Management Zones to the south and west. On the Gardiner Ranger District, there are two active (6/16 grazing season entry dates) and three vacant cow/calf pair allotments within the Northern Bison Tolerance Zone and three active cow/calf pair allotments in Tom Miner Basin outside of but near the Northern Bison Management Zones. There have been no issues with bison and cattle co-mingling on these allotments due to spatial and temporal separation. In light of severe winters and in balancing the capacity of the forage base in Yellowstone National Park, maintaining genetic diversity, and preserving migratory behavior, a population of 2,500 to 4,500 bison is sustainable. In light of social tolerance issues, the prevention of further dispersal and range expansion, hunting and culling operations would be need to be used to manage populations.

The key role of the Custer Gallatin National Forest relative to bison is to provide and improve suitable habitat. If 10 percent of the available forage was allocated to bison, there is forage for 1,177 bison year-round or 2,354 bison for 6 months in the Madison, Gallatin, and Absaroka Mountain Ranges. Habitat improvements such as prescribed burning, aspen and meadow restoration, thinning and patch cuts in forest, and restoration of native grass species are all management actions that could increase this capacity.

Mule Deer

Current Forest Plan Direction

The current Custer Forest Plan lists mule deer as a key species of interest for management area D on the Ashland and Sioux Districts. No specific management standards are outlined concerning mule deer; however, the Custer Plan contains monitoring requirements for deer winter range. Mule deer are not specifically addressed in the Gallatin Forest Plan, but rather are included in big management direction.

Existing Condition

Mule deer occur across the plan area. They are typically found in the more open habitats of the Montane Ecosystem, but spend time in the subalpine coniferous forest types as well. In the pine savanna ecosystem, they are found in ponderosa pine forest, on sagebrush slopes, in woody draws, and badlands. During the daytime, mule deer seek out areas with rougher terrain that provides escape routes from predators as well as human disturbance. Mule deer typically browse on woody plant species, but also graze on herbaceous forbs and grasses (Foresman 2012).

Trends and Drivers

The States of Montana and South Dakota are charged with the management of mule deer. Trend information was obtained from these agencies and reported by landscape area below.

Madison, Henrys, Gallatin and Absaroka and Beartooth Mountains

For combined hunting districts 360 and 362 in the Madison Range, the approximate mean annual population growth for the time periods from 1997 to 2016, and 2006 to 2016 is 1.4 percent and 2.9 percent, respectively (Montana Fish, Wildlife & Parks 2016). District 520 (Beartooth and portion of Absaroka Mountains) population size -35 percent, percent buck harvest -40 percent; District 560 (Portions of Absaroka and Gallatin Mountains) population size -8.8 percent, percent buck harvest -14 percent (Montana Fish, Wildlife & Parks 2015).

Bridger, Bangtail, and Crazy Mountains

In Montana Fish, Wildlife & Parks Region 3, population trends for hunting district 312 that encompass the Bridger Mountains expressed in approximate mean annual population growth for the time periods between 1972–2016 and 2006–2016 is 3.7 percent and 2.3 percent, respectively. District 580 (portion of Crazy Mountains) population size +17.1 percent, percent buck harvest -23 percent.

Pryor Mountains

District 510 (Pryor Mountains) population size not reported, percent buck harvest -11 percent.

Ashland District

Montana Fish, Wildlife & Parks has one monitoring trend survey area on the Ashland Ranger District located in the vicinity of Otter Creek. Average annual spring survey observations for mule deer between the years of 1980–2015 and 2005–2015 are 90 and 99, respectively. Post-hunting season observation for the same area between the years of 1985–2015 and 2005–2015 are 78 and 63, respectively. The Forest Service conducted spotlight surveys on the Ashland District over nine nights in late August and early September in 2015. Just over 186 miles of roads and all available habitat types were sampled. There were 169 mule deer observations totaling 366 individuals. Program DISTANCE was used to estimate population sizes. Pooled density for mule deer across habitat types was 143 acres/deer. Mule deer density for the five habitat types analyzed was: herbaceous (125 acres/deer), shrubland (500 acres/deer), sparse vegetation (no observations), pine forest (91 acres/deer), and deciduous trees (143 acres/deer). For the Ashland District there were an estimated 4,291 mule deer (95 percent confidence interval 2,688–7,287 mule deer).

Sioux District

There are no Montana Fish, Wildlife & Parks trend areas on the Sioux District. However, in southeast Montana (Ashland and Sioux Districts) mule deer populations demonstrate yearly variation, but no steady decline has occurred over the last 30 years (Waltee and Foster 2014). The Montana Fish, Wildlife & Parks accesses and sometimes adapts harvest regulations annually to manage mule deer populations. State management has resulted in stable buck harvest numbers with declining proportion of yearling bucks, increasing proportion of mature bucks older than 4.5 years, and minimal differences between bucks harvested on Forest Service land and non-Forest Service land (Waltee and Foster 2014). Data provided by South Dakota Game, Fish, and Parks for mule deer information were insufficient to draw meaningful inferences.

White-tailed Deer

Current Forest Plan Direction

The current Custer Forest Plan lists whitetail deer as a habitat indicator species for “dog-hair” ponderosa habitat types and a key species of interest for management area D on the Sioux District. An additional guiding document recommends habitat management guidelines for whitetail deer on the Sioux District (Edwards 1986). No specific management standards are outlined concerning white-tailed deer; however, the Custer Plan contains monitoring requirements for deer winter range. White-tailed deer are not specifically addressed in the Gallatin Forest Plan, but rather are included in big management direction.

Existing Condition

Whitetail deer occur across the plan area, but are typically found in higher densities at lower elevation bottom lands (i.e., outside the plan area boundary) in the Montane Ecosystem. The preponderance of suitable habitat for this species is located in the pine savanna ecosystem (east-side of the plan area). Whitetail deer are more associated with riparian and agricultural areas than mule deer in Montana and South Dakota. Whitetail deer are typically found closer to hiding cover provided by deciduous vegetation than mule deer. Edwards (1986) defines four types of habitat required by whitetail deer on the Sioux District: diversity, forage, hiding cover, and thermal cover.

Trends and Drivers

Montana Fish, Wildlife & Parks has one monitoring trend survey area on the Ashland Ranger District located in the vicinity of Otter Creek which is primarily used to estimate trends in mule deer populations; however, incidental observations are also recorded. There have been no incidental observations of whitetail deer in the Otter Creek trend area since records have kept starting in 2006. There are no Montana Fish, Wildlife & Parks trend areas on the Sioux District. However, estimates of whitetail deer density in the Long Pines Unit on the Sioux District from 1976 to 1986 were 28 to 38 acres/deer (Edwards 1986). In Montana Fish, Wildlife & Parks Region 5 there are four hunting districts that encompass portions of the Custer Gallatin National Forest and for which population trend data were provided: District 510 (Pryor Mountains), District 520 (Beartooth and portion of Absaroka Mountains), District 560 (Portions of Absaroka and Gallatin Mountains) and District 580 (Portion of Crazy Mountains).

In Montana Fish, Wildlife & Parks Region 5 population trends for hunting districts that encompass portions of the Custer Gallatin National Forest expressed in the percent deviation from the long-term average for population size and percent buck harvest for 2015 and 2014, respectively, are: District 510 (Pryor Mountains) population size not reported, percent buck harvest -7 percent; District 520 (Beartooth and portion of Absaroka Mountains) population size +107 percent, percent buck harvest +14 percent; District 560 (Portions of Absaroka and Gallatin Mountains) population size +26 percent, percent buck harvest +77 percent; and District 580 (Portion of Crazy Mountains) population size +17 percent, percent buck harvest -4 percent (Montana Fish, Wildlife & Parks 2015).

Pronghorn Antelope

Existing Condition

The range of pronghorn antelope includes the entire plan area; however, little to no suitable habitat for this species is present on the Madison, Henrys, Gallatin and Absaroka and Beartooth Mountains, Bridger, Bangtail, and Crazy Mountains, Pryor Mountains, or most of the Sioux District. The majority of suitable pronghorn habitat on the Custer Gallatin National Forest is on the Ashland District and open grassland habitat areas below the rocky escarpments which typify the Sioux District. There are 196 recorded pronghorn antelope observations on the Custer Gallatin National Forest (Montana Natural Heritage Program 2016). Distribution of observations are: Madison, Henrys, Gallatin and Absaroka and Beartooth Mountains (4), Bridger, Bangtail, and Crazy Mountains (0), Pryor Mountains (1), Ashland District (184), Sioux District (7).

Montana Fish, Wildlife & Parks has one monitoring trend survey area on the Ashland Ranger District located in the vicinity of Otter Creek which is primarily used to estimate trends in mule deer populations. However, incidental observations are also recorded. Average annual spring survey incidental observations for pronghorn between the years of 2012 and 2015 is 65. Post-hunting season incidental observation for the same area between the years of 2006 and 2015 is 97. There are no Montana Fish, Wildlife & Parks trend areas on the Sioux District. Requests for pronghorn data from Montana Fish, Wildlife & Parks in other portions of the Custer Gallatin National Forest were not fulfilled. In 2013 Montana Fish, Wildlife & Parks estimated the total number of pronghorn in area 704 which encompass the Ashland District to be 5,511, and area 705 which encompass the Montana portion of Sioux Districts to be 13,188 (Ellenberger and Byrne 2015).

South Dakota Game, Fish and Parks provided annual population estimates for pronghorn in Harding County between 2006 and 2015. Estimates range from a high of 19,929 in 2007 to a low of 4,244 in 2012. The mean annual percent rate of growth between 2006 and 2015 is minus 5.3 percent. However, during this time period pronghorn populations have demonstrated two distinct population trajectories. Between 2007 and 2012 the mean annual percent rate of growth was minus 24.4 percent; however, since that time 2012 populations have been recovering at a mean percent rate of growth of 10.1 percent annually.

The Forest Service conducted spotlight surveys on the Ashland District over 9 nights in late August and early September in 2015. Just over 186 miles of roads and all available habitat types were sampled. There were 15 pronghorn observations totaling 95 individuals. Program DISTANCE was used to estimate population sizes. Pooled density for pronghorn across habitat types was 500 acres/pronghorn. Pronghorn density for the 5 habitat types analyzed was: herbaceous (333 acres/pronghorn), shrubland (1,000 acres/pronghorn), sparse vegetation (no observations), pine forest (no observations), and deciduous trees (no observations). For the Ashland District there were an estimated 748 pronghorn antelope (95 percent confidence interval 242–2,697 pronghorn antelope).

Trends and Drivers

The States of Montana and South Dakota are charged with the management of pronghorn antelope. The best source for general trend data in the hunting districts 704 and 705 that encompass the Ashland and Sioux Districts, respectively, is a report prepared by the National Wildlife Federation (Ellenberger and Byrne 2015). For hunting districts 704 and 705 which encompass the Ashland and Montana portions of the Sioux Districts, respectively long-term trends for pronghorn populations have been increasing. The long-term average for district 704 is 5,511 and the 2013 estimate was 10,386, 88 percent above the long-term average. The long-term average for district 705 is 12,947 and the 2013 estimate was 13,188, 2 percent above the long-term average.

Pronghorn populations in Harding County, South Dakota, which encompasses the South Dakota portion of the Sioux District is divided into two pronghorn management units east and west of highway 85. The east and west pronghorn management units in Harding County have a population management objective of 6,000 (1.73 pronghorn/section) and 8,000 (2.39 pronghorn/section), respectively. The 2014 population estimate for east and west pronghorn management units in Harding County were 2,305 and 3,232 respectively (South Dakota Game, Fish and Parks 2014). Pronghorn populations in Harding County, South Dakota, are currently below management objectives.

Upland Game Birds

Sharp-tailed Grouse

Current Forest Plan Direction

The current Custer Forest Plan lists sharp-tail grouse as the management indicator species for grassland habitat types and stipulates that 12 inches of residual nesting cover is required to meet their nesting needs (page 181). In the monitoring requirements section of the Custer Forest Plan, requirement C9 stipulates that when less than 90 percent of dancing/booming grounds have an average stubble height of 12 inches remaining within a 1-mile radius further evaluation is required (page 106). Grouse standards and monitoring requirements do not exist for the Gallatin Forest Plan.

Existing Condition

There are 108 recorded sharp-tailed grouse observations on the Custer Gallatin National Forest (Montana Natural Heritage Program 2016). Distribution of observations are: Madison, Henrys, Gallatin and Absaroka and Beartooth Mountains (6), Bridger, Bangtail, and Crazy Mountains (1), Pryor Mountains (0), Ashland District (82), Sioux District (20). Sharp-tailed grouse have been observed on 42 of 43 monitored leks on the Ashland District and 2 out of 3 monitored leks on the Sioux District. However, leks on Sioux District have not been monitored since 1979 (Montana Fish, Wildlife & Parks data).

Habitat Use and Distribution

Sharp-tailed grouse use a variety of open, relatively treeless habitats including shrub steppe, meadow steppe, mountain shrub, brushy grassland, and riparian/deciduous habitats. They often use transitional areas between habitat types, especially when the area contains a mixture of vegetative species and structure. Good sharp-tail habitat contains a mix of grasses, forbs, and many species of shrubs. Sharp-tails primarily choose habitat based on openness of landscape, height and density of vegetation, and type of vegetation. Preferred vegetation types vary greatly by geographic region. Sharp-tails prefer flat to gentle topography over steep slopes. There is no direct evidence that sharp-tails need open water, even in summer. They may eat snow during winter (NRCS 2007).

Mating takes place on leks, where male sharp-tails perform courtship displays to attract females. Sharp-tails use a variety of sites as leks including rangeland, cropland, plowing, and roads. Leks usually occur in open, elevated areas such as knolls, ridge tops, hilltops, benches, or flat areas providing a broad horizontal view of the surroundings. Sharp-tails prefer leks sites with short, sparse vegetation such as grasses, weeds, forbs, and some shrubs. Sparse and open vegetation on leks enables aggressive displays by males and minimizes predation. Sparse shrubs providing escape cover from predators, are often found adjacent to leks. Leks are sometimes associated with recently burned or grazed sites. Changes in land use on a lek resulting in taller, denser vegetation have been shown to cause eventual abandonment of the lek. Leks cover a relatively small area ranging from the size of a small house to a baseball diamond. Lek locations are generally traditional from year to year, providing the habitat is still suitable. Lek locations may change if a lek is covered with water, or if taller, denser vegetation develops (Natural Resources Conservation Service 2007).

Suitability for nesting and brood rearing depends on the amount, height, and density of vegetation, especially forbs and grasses from the previous year. Nests are in vegetative cover that is denser than surrounding areas. Nesting habitat varies according to geographic location and vegetation type. Generally, habitat that is structurally diverse, including stands of grasses, shrubs, and forbs, provides high-quality nesting areas (Natural Resources Conservation Service 2007).

Once the chicks are hatched, brood habitat must supply an abundant source of insect food, as well as cover to protect chicks from predation. Females prefer to raise broods in areas with abundant and diverse vegetation including shrubs, forbs, broadleaf plants, and grasses. These areas contain abundant insects that chicks depend on for food (Natural Resources Conservation Service 2007).

Sharp-tail winter habitats include shrubby rangelands, riparian areas, mountain shrub communities, and deciduous and open coniferous woods. Though they are not considered migratory, sharp-tailed grouse may move short distances (less than 21 miles) to winter in woody habitats when snow covers foraging areas. This movement usually occurs between late November and early January, though the timing is strongly influenced by snow. Although plant species vary among regions, winter habitats are generally characterized by stunted trees or tall shrubs that are used for feeding, roosting, and escape cover. Winter habitat that provides cover must also provide food (Natural Resources Conservation Service 2007).

Based on recorded observations and Montana Fish, Wildlife & Parks monitoring efforts the majority of sharp-tail habitat on the Custer Gallatin National Forest is located on the Ashland and Sioux Districts. Sharp-tail habitat is not widespread on the Madison, Henrys, Gallatin and Absaroka and Beartooth Mountains, the Bridger, Bangtail, and Crazy Mountains, or Pryor Mountains.

Trends and Drivers

The most important factors limiting sharp-tail populations are the loss of open landscape caused by fire suppression, succession, and tree encroachment of grassland habitats. Other pressures on population include over grazing, predation, hunting, and disease, though these factors are minor compared to the overall loss of habitat (Natural Resources Conservation Service 2007).

Grazing can be a useful habitat management technique if used properly. Grazing can remove the accumulated standing litter and keeps vegetative succession under control. Rest-rotation and deferred grazing are preferred over season-long grazing and can increase forage production to benefit sharp-tails. For rest-rotation to be effective, residual grass should be left for nesting cover and some residual herbaceous vegetation should remain each fall. This standing vegetation will then be available for nesting and brood-rearing the following spring. Grazing systems need to be designed to meet the local conditions. It is recommended that if a grazing system is to be used, assistance is sought to aid in the development of a plan that fits the resource and management goals of the area. Livestock should be fenced out of stands of deciduous shrubs and trees, particularly in riparian areas. Overgrazing by livestock leads to a deterioration of sharp-tail habitat and increases in grazing pressure are a principal threat to the continued existence of some sharp-tail populations. Excessive grazing reduces the amounts of grasses and forbs necessary for nesting and brood-rearing cover and destroys deciduous trees and shrubs by trampling, browsing, and rubbing. The destruction of deciduous trees and shrubs is particularly harmful in riparian habitats that provide critical foraging areas and escape cover for sharp-tails in the winter. In the short term, excessive grazing may only remove nesting cover for a single season. However, continuous overgrazing can alter the vegetative composition of sharp-tail habitat, resulting in grasses, forbs, and shrubs that will not sustain sharp-tails. Overgrazing can be avoided in sharp-tail habitat by implementing grazing management practices. Properly managed grazing can lead to a diversity of plant cover to benefit sharp-tails (Natural Resources Conservation Service 2007).

The States of Montana and South Dakota are charged with the management of sharp-tail grouse and the primary source for population/trend data. Broader population trend data at the state level was obtained from the USGS Breeding Bird Survey.

The majority of sharp-tail grouse habitat on the Custer Gallatin National Forest occurs in the "badlands and prairies" bird conservation region which encompasses the Ashland and Sioux Districts. The Pryor Mountains and plan areas further west are in the Northern Rockies Bird Conservation Region. Breeding bird surveys have documented long-term population trends in both of these regions. The annual percent increase in survey detection between 1966 and 2013 and between 2003 and 2013 for the Badlands and Prairies is 0.27 and 4.59, respectively. The annual percent increase in survey detection between 1966 and 2013 and between 2003 and 2013 for the Northern Rockies is 1.97 and 3.73, respectively (Sauer et al. 2014).

Wild Turkey

Current Forest Plan Direction

The current Custer Forest Plan lists wild turkey as a key species of interest for management area D on the Sioux District; however, no specific standards are outlined concerning wild turkey. Wild turkey standards and monitoring requirements likewise do not exist for the Gallatin Forest Plan.

Existing Condition

There are 423 recorded wild turkey observations on the Custer Gallatin National Forest (Montana Natural Heritage Program 2016). Distribution of observations are: Madison, Henrys, Gallatin and

Absaroka and Beartooth Mountains (14), Bridger, Bangtail, and Crazy Mountains (0), Pryor Mountains (4), Ashland District (341), Sioux District (64).

Habitat Use and Distribution

Wild turkeys in western South Dakota and Southeast Montana typically use larger diameter at breast height (DBH) ponderosa pine trees (greater than 11 inches [30 centimeters] DBH) than found at random, and usually larger trees have more open branch spacing which is an important factor of roost-site selection (Rumble 1990, 1992; Thompson 2003; Thompson et al. 2009; cited in South Dakota Game, Fish and Parks 2016). Additionally, wild turkeys used roosting areas with lowered tree densities and less downed woody debris on the forest floor providing for easier access for roost entry and exit (Thompson 2003, cited in South Dakota Game, Fish and Parks 2016). Further, for roost sites in the western South Dakota wild turkeys usually select a different roost site each night unless the roost site is near consistent agricultural food sources such as at ranches, and typically, roost sites have not had recent timber activity (Rumble 1990, 1992; Thompson 2003; cited in South Dakota Game, Fish and Parks 2016).

Analysis of macrohabitats (third-order habitats) (Johnson 1980, cited in South Dakota Game, Fish and Parks 2016) indicated there were no patterns of nest site selection (Rumble and Hodorff 1993, cited in South Dakota Game, Fish and Parks 2016). However, research at the fine scale (fourth-order habitats) (Johnson 1980, cited in South Dakota Game, Fish and Parks 2016) suggests concealment cover or visual obstruction from common juniper shrubs and woody debris were important for concealing first nests, while deciduous shrubs such as snowberry were used for renests in western South Dakota (Petersen and Richardson 1975; Rumble and Hodorff 1993; Lehman et al. 2008a; cited in South Dakota Game, Fish and Parks 2016). Increased slope at nest sites may also be an important component for nest survival (Petersen and Richardson 1975; Rumble and Hodorff 1993; Lehman et al. 2008a; cited in South Dakota Game, Fish and Parks 2016).

In the Black Hills which are somewhat similar to Ashland and Sioux Districts, females with poults select for meadow and open pine habitats at large scales (Rumble and Anderson 1993a; Rumble and Anderson 1993b; Lehman et al. 2012; cited in South Dakota Game, Fish and Parks 2016). During spring, grass and forb foliage, grass seeds, and forb seeds/flowers comprised large proportions of adult wild turkey diets from late winter through spring (Rumble and Anderson 1996a; cited in South Dakota Game, Fish and Parks 2016). During summer more invertebrates are available in meadow and open pine habitats and sites where hens were feeding with poults had greater abundance of invertebrates than found at random sites (Rumble and Anderson 1996a; Lehman 2005; cited in South Dakota Game, Fish and Parks 2016). As poults get larger and more developed later in the summer and early fall they use meadow habitat less and forests more (Rumble and Anderson 1993b). At the microhabitat scale females with poults selected sites with greater herbaceous biomass and less overstory canopy cover, and foraging sites were close to meadow-forest ecotones (Rumble and Anderson 1996b; Rumble and Anderson 1997; cited in South Dakota Game, Fish and Parks 2016). It is recommended that managers maintain 1,043 to 1,165 pounds/acre (1,170 to 1,306 kilograms/hectare) herbaceous biomass through August in the Black Hills to provide poult-rearing habitat (Rumble and Anderson 1997; Lehman et al. 2012; cited in South Dakota Game, Fish and Parks 2016).

The Ashland and Sioux Districts of the Custer Gallatin National Forest are similar to the Black Hills, in that ecosystems are disturbance based and formed through fire (primarily lightning strikes), insects, storms, disease, and wild ungulate grazing. These disturbances are critical components to sustain biological diversity (USDA 1986b; USDA 1986c; cited in South Dakota Game, Fish and Parks 2016).

The range of wild turkey includes the entire plan area, however Based on recorded observations and Montana Fish, Wildlife & Parks monitoring efforts the majority of wild turkey habitat on the Custer Gallatin National Forest is located on the Ashland and Sioux Districts. Wild turkey habitat is not widespread on the Madison, Henrys, Gallatin and Absaroka and Beartooth Mountains, the Bridger, Bangtail, and Crazy Mountains, or Pryor Mountains.

Trends and Drivers

Livestock grazing typically occurs in meadows and open habitats which overlaps with resource selection of hens with poults during the summer months. If meadows or other open-canopied habitats are overgrazed, it can present a challenge for managers interested in wild turkey poult survival. If overgrazing removes nearly all the herbaceous vegetation, the needed concealment cover and foraging resources for poults is eliminated (Flake et al. 2006; cited in South Dakota Game, Fish and Parks 2016). Herbaceous biomass provides cover to avoid predation, and the invertebrates needed for foraging is correlated with grass and forb biomass.

Grazing can be a useful habitat management technique if used properly. Grazing can remove the accumulated standing litter and keeps vegetative succession under control. Rest-rotation and deferred grazing are preferred over season-long grazing and can increase forage production to benefit wild turkey. For rest-rotation to be effective, residual grass should be left for nesting cover and some residual herbaceous vegetation should remain each fall. This standing vegetation will then be available for nesting and brood-rearing the following spring. Overgrazing by livestock leads to a deterioration of wild turkey habitat. Excessive grazing reduces the amounts of grasses and forbs necessary for nesting and brood-rearing cover and destroys deciduous trees and shrubs by trampling, browsing, and rubbing. The destruction of deciduous trees and shrubs is particularly harmful in riparian habitats that provide critical foraging areas and nesting and escape cover for wild turkey. Overgrazing can be avoided in wild turkey habitat by implementing grazing management practices. Properly managed grazing can lead to a diversity of plant cover to benefit wild turkey (Natural Resources Conservation Service 2007).

The States of Montana and South Dakota are charged with the management of wild turkey however population/trend data are limited. Broader population trend data at the state level was obtained from the USGS Breeding Bird Survey.

The majority of wild turkey habitat on the Custer Gallatin National Forest occurs in the “badlands and prairies” bird conservation region which encompasses the Ashland and Sioux Districts. The Pryor Mountains and plan areas further west are in the Northern Rockies Bird Conservation Region. Breeding bird surveys have documented long-term population trends in both of these regions. The annual percent increase in survey detection between 1966 and 2013 and between 2003 and 2013 for the Badlands and Prairies is 8.52 and 9.02, respectively. The annual percent increase in survey detection between 1966 and 2013 and between 2003 and 2013 for the Northern Rockies is 14.08 and 17.48, respectively (Sauer et al. 2014).

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Appendix A: Species Evaluated and Not Identified as a Potential Wildlife Species of Conservation Concern

The species listed in Table A-1 were evaluated, but not identified as potential wildlife species of conservation concern.

Table A-1. Species evaluated, but not identified as potential wildlife species of conservation concern

Species Name	Conservation Ranking	Distribution in Plan Area[1]	Rationale for Evaluating and Identifying or Not as Potential Species of Conservation of Concern
Birds			
Baird's Sparrow (*Ammodramus bairdii*)	G4 MT S3B SD S2B	Only two observations of this species in the plan area, both on Montana portion of the Sioux District. Three individuals were detected during the breeding season, but breeding was not confirmed. The Pryors, Ashland, and Sioux landscapes are within the range of the species.	Evaluated due to state ranking for South Dakota. This species is on the Region 1 Sensitive Species list as known to occur on the Custer National Forest. Not identified as potential species of conservation concern. Insufficient evidence the species is established or becoming established in the plan area. The species has been located near, but not within the South Dakota portion of the plan area.[3] Breeding bird survey data from 1966–2010 show significant decline in numbers survey-wide, but stable in Montana.[2] Abundance and distribution of the species appears stable in South Dakota.[3] Threats include conifer encroachment and over-grazing, draining of wet meadows and cowbird parasitism.[3]
Bald Eagle (*Haliaeetus leucocephalus*)	G5 MT S4 SD S1B, S2N	Known to occur throughout the plan area, including South Dakota portion.	Evaluated due to state ranking in South Dakota. Sensitive species on Beaverhead-Deerlodge National Forest, Caribou-Targhee National Forest and Shoshone National Forest. This species is on the Region 1 Sensitive Species list as known to occur on the Custer and Gallatin. The bald eagle was delisted in 2007 and is monitored by state and Federal agencies. Not identified as potential species of conservation concern. In Montana, bald eagle populations have steadily increased since the 1980s, including a 96 percent increase in breeding pairs from the year 2000 to 2010 (Montana Natural Heritage Program), and continued increase through 2015 (Montana Bald Eagle Working Group 2016). In South Dakota, bald eagle numbers have "exploded" since 1993, and breeding has been confirmed within, or adjacent to, the plan area.[3] Observations of individuals and breeding pairs have increased in the plan area in the last decade.
Black and White Warbler (*Mniotilta varia*)	G5 MT S4 SD S2, S3B	Only one observation in plan area of a transient (migratory) individual, dating back to 1956. Montana Heritage shows Ashland and Sioux as summer range; NatureServe shows Ashland and Sioux as passage migrant range. The Montane	Evaluated due to State ranking for South Dakota. Not identified as potential species of conservation concern. Insufficient evidence of species presence in plan area. Limited suitable habitat for other than transient use. The plan area is located in the extreme northwest corner of South Dakota, which is considered migratory range for the species in South Dakota. Breeding range for the species is found in the Black Hills, and southern portion of the state.[3]

Species Name	Conservation Ranking	Distribution in Plan Area[1]	Rationale for Evaluating and Identifying or Not as Potential Species of Conservation of Concern
		Ecosystem landscapes are outside the range for this species.	No nests have been found in Montana.
Black Rosy Finch (*Leucosticte atrata*)	G4 MT S2 SD Not Ranked	Only a few, mainly migratory individuals have been observed across the Montane Ecosystem, but indirect evidence of breeding has been documented. Summer range in Bridgers, Bangtails and Crazy Mountains. Year-round range in Madison, Gallatin and Absaroka and Beartooth. Pryors and Pine Savanna landscapes are outside the specie's range.	Evaluated due to State ranking in Montana. Not identified as potential species of conservation concern. The S2 ranking is partly due to lack of information for this species. Nesting habitat is typically above treeline where few vegetation management activities occur. No management concerns are listed at this time (Montana State Wildlife Action Plan, Montana Natural Heritage Program). Habitat: Mountain ranges with peaks over 3,200 meters (10,500 feet) in height.[2] Majority of suitable habitat found in designated wilderness areas. Species known mostly from Park County, south-central Montana; large flocks recorded in Red Lodge prior to breeding in Absaroka-Beartooth Wilderness.[2]
Black Swift (*Cypseloides niger*)	G4 MT S1B SD No Record	One observation (dating back to 1962) of a transient individual in northwestern extent of plan area. No detections in plan area during Forest Service landbird monitoring surveys.	Evaluated due to state ranking of S1B. This species is on the Region 1 Sensitive Species list, but not known or suspected to occur on either Custer or Gallatin. Not identified as potential species of conservation concern. Insufficient evidence of species presence in plan area. State rank of S1B refers to breeding range. Entire plan area is outside the range for this species.
Black-backed Woodpecker (*Picoides arcticus*)	G5 MT S3 SD S3	Most of the plan area is year-round ranger for this species. Observations have been recorded across the plan area, except for the Sioux District. Indirect evidence of breeding has been documented in the Madison/Gallatin/ Absaroka and Beartooth landscape and the Ashland District in recent years.	Evaluated due to Sensitive designation on Beaverhead-Deerlodge National Forest and Shoshone National Forest. This species is on the Region 1 Sensitive Species list as known to occur on the Custer and Gallatin. Not identified as potential species of conservation concern. The species is present across most of the plan area. Habitat is abundant due to recent fires and insect outbreaks across the plan area. Threats: fire suppression, fuel reduction, post-fire salvage logging.[2]
Blue-gray Gnatcatcher (*Polioptila caerulea*)	G5 MT S2B SD S1B	Species has been observed, including indirect evidence of breeding, in the Pryor Mountains. Fairly common breeding resident in canyons along the southwest edge of Pryors[2]; however, all confirmed breeding is outside plan area (Montana Natural Heritage Program). Two observations in the South Dakota portion of the Sioux District, likely transient individuals (South Dakota Natural Heritage Program). NS range maps exclude Montana and South Dakota.	Evaluated due to state ranking in Montana and South Dakota. This species is on the Region 1 Sensitive Species list as known to occur on the Custer. Not identified as potential species of conservation concern. Species occurrence is limited to a small portion of the plan area in Montana and South Dakota, where detections have been near the edge of the administrative boundary. Established range for this species is generally well south and east of the plan area. However, the range is expanding to the north and west[3], and recent observations here may be evidence of this range expansion (Montana Fish, Wildlife & Parks 2015). Blue-gray gnatcatchers arrived fairly recently in South Dakota, are rapidly

Species Name	Conservation Ranking	Distribution in Plan Area[1]	Rationale for Evaluating and Identifying or Not as Potential Species of Conservation of Concern
			expanding, and are known to occur within the plan area[3]. Livestock grazing may have indirect impacts due to cowbird parasitism for this species.
Boreal Owl (*Aegolius funereus*)	G5 MT S3S4 SD No Record	Known to occur throughout its range in the Montane Ecosystem of the plan area. Pryors, Ashland and Sioux landscapes lack suitable habitat (e.g., boreal forest) and are outside the specie's range.	Evaluated due to sensitive designation on Shoshone National Forest. Not identified as potential species of conservation concern. Dropped from Montana species of concern list in 2001; found to be more common than previously recognized (Montana Natural Heritage Program). Population size and trend unknown; occurrence well-distributed across suitable habitat in plan area. Threats: loss of mature boreal forest types due to logging /fire. Naturally small pops vulnerable to deforestation.[2]
Brewer's Sparrow (*Spizella breweri*)	G5 MT S3B SD S2B	Species occurs, with direct and indirect evidence of breeding throughout plan area, including the portion in South Dakota (Montana Natural Heritage Program, South Dakota Natural Heritage Program). Entire plan area is within summer/breeding range for this species.	Evaluated due state ranking in South Dakota; identified as sensitive on Shoshone National Forest. Not identified as potential species of conservation concern. Uncommon but well-distributed across plan area. Species evaluated due to state rank in South Dakota; where there are observations including indirect evidence of breeding. Breeding bird survey data from 1966–2010 show pop declines in Montana but not statistically significant. Breeding bird survey data from 1966–2003 show a small population increase in South Dakota, (not statistically significant)[3] and is evaluated fairly common in South Dakota portion of the plan area.[3] Threats: loss of sagebrush habitat due to fire and invasive plants. Livestock grazing can be beneficial if it increases sage cover.[2]
Brown Creeper (*Certhia americana*)	G5 MT S3 SD S2B, S3N	Observational data and confirmed breeding pairs are present throughout the plan area, including one record with indirect evidence of breeding in South Dakota portion. Most of plan area is within year-round range. More common in mature spruce-fir, and mixed conifer forests than in pine or younger forests in western Montana.[2]	Evaluated due to state ranking in South Dakota. Not identified as potential species of conservation concern. The species is present and well-distributed across the plan area in Montana. The plan area is within winter range for this species in South Dakota, but the species is evaluated rare in Harding County[3], which is where the plan area is located. Greatest threat is logging. Species strongly associated with mature to old-growth forest; avoids clearcuts and partially logged areas.[2]
Bufflehead (*Bucephala albeola*)	G5 MT S5 SD S1BS2N	Uses smaller ponds and marshes, avoids larger lakes. Known to use suitable habitat throughout the plan area. Montane Ecosystem is year-round range, pine-savanna ecosystem is migratory range for this species.	Evaluated due to state ranking in South Dakota. Not identified as potential species of conservation concern. Secure globally and in majority of plan area. Species is typically present in suitable habitat within the plan area. South Dakota portion of plan area is passage migrant range, and the species is not known to breed there (South Dakota Game, Fish and Parks). Threats identified for the species in South Dakota are associated with breeding habitat.[3]

Species Name	Conservation Ranking	Distribution in Plan Area[1]	Rationale for Evaluating and Identifying or Not as Potential Species of Conservation of Concern
Burrowing Owl (*Athene cunicularia*)	G4 MT S3B SD S3, S4B	Known to occur only on Ashland and Sioux Districts (generally associated with black-tailed prairie dog towns). There are more observations near, but outside the plan area in lower-elevation grassland types, which are more common in surrounding private and BLM lands. Entire plan area is within summer/breeding range for this species.	Evaluated due to sensitive designation on Shoshone National Forest. This species is on the Region 1 Sensitive Species list as known to occur on the Custer. Not identified as potential species of conservation concern. Monitoring and multi-species conservation efforts for prairie and grassland birds resulted in a downgrading of the Montana species of concern rank for the burrowing owl from "at risk" to "potentially at risk" (Montana State Wildlife Action Plan 2015:328). Dependent upon prairie dog communities, which are small, but persist on the Ashland District. Breeding bird survey data show short term (1999–2009) population trends as stable to slightly increasing in North America (NS 2016). Long-term breeding bird survey data (1966–2010) show insignificant pop declines in Montana[2] and significant declines in South Dakota (1966–2003).[3] Threats include permanent habitat loss and black-tailed prairie dog eradication.[2] Prairie dog shooting may result in illegal mortality of burrowing owls. Past, systematic suppression of prairie dog towns has caused a decline in owl habitat, but the impact to owl populations is unknown.
California Gull (*Larus californicus*)	G5 MT S5 SD S2B	Generalist species associated with larger lakes; mainly uses islands for nesting. Primarily migratory on Ashland and Sioux Districts; however, known to use suitable habitat throughout the plan area.	Evaluated due to state ranking in South Dakota. Not identified as potential species of conservation concern globally secure, secure in Montana and widely distributed across suitable habitat within plan area. South Dakota rating of S2B is associated with breeding habitat, and the plan area portion of South Dakota is migratory range for this species.[3]
Cassin's Kingbird (*Tyrannus vociferans*)	G5 MT S4 SD S2B	Occurs only in the Pine Savanna Ecosystem of the plan area, but is relatively common on the Ashland District, including during breeding season, and has been detected on the Sioux District as well.	Evaluated due to state ranking in South Dakota. Not identified as potential species of conservation concern. The species is globally secure, apparently secure in Montana, and relatively common in the Pine Savanna Ecosystem of the plan area. South Dakota portion of plan area is outside the range of this species, and Cassin's kingbirds are not known to breed there.[3]
Chestnut-collared Longspur (*Calcarius ornatus*)	G5 MT S2B SD S4B	Only one transient observation dating back to 1989 within the plan area. This observation is at the edge of the plan area, with an estimated accuracy of 25,000 meters. Pryor Mountains and pine-savanna landscapes are within summer/breeding range.	Evaluated due to state ranking in Montana. Not identified as potential species of conservation concern. Insufficient evidence of species presence within plan area. Montana rank is due to species dependence on native prairie and sensitivity to overgrazing by livestock; non-native grasses also noted as threat. Breeding bird survey data indicate significant population declines in Montana.[2]
Clark's Nutcracker (*Nucifraga columbiana*)	G5 MT S3 SD S2	Common and widely distributed across portion of plan area in Montana. Not known in plan area in South Dakota.	Evaluated due to South Dakota state rank. Not identified as potential species of conservation concern. Globally secure, common and widely distributed over most of plan area. Most of

Species Name	Conservation Ranking	Distribution in Plan Area[1]	Rationale for Evaluating and Identifying or Not as Potential Species of Conservation of Concern
			the plan area in Montana is year-round range for this species. However, in South Dakota, the Clark's nutcracker is found only in the Black Hills (outside plan area).[3] Threats: loss of whitebark and limber pine due to insects, disease, and fire[2], or lack of disturbance due to fire suppression.[3]
Common Loon (*Gavia immer*)	G5 MT S3B SD S1BS2N	Only infrequent, transient use documented for this species within the Montane Ecosystem of the plan area. No observations in the Pryor Mountains, Ashland District, or Sioux District. Entire plan area is in passage or migratory range of the species (Montana Natural Heritage Program).	Evaluated due to state ranking in South Dakota; sensitive species on Caribou-Targhee National Forest. This species is on the Region 1 Sensitive Species list, but is not known or suspected to occur on the Custer or Gallatin. Not identified as potential species of conservation concern. Species presence is rare, and transient within the plan area. Insufficient evidence the species is established or becoming established within the plan area. The South Dakota portion of the plan area is migratory range, and the species is not known to breed there.[3]
Common Merganser (*Mergus merganser*)	G5 MT S5 SD S2BS3N	Mainly migratory observations recorded for this species in the plan area, but it is known to occur, and reproduce, on larger lakes and rivers within the plan area. The plan area in Montana is year-round range.	Evaluated due to state ranking in South Dakota. Not identified as potential species of conservation concern. Secure globally and in Montana. The species is relatively common in suitable habitat across the plan area. Evaluated for South Dakota ranking of breeding habitat; however, South Dakota portion of plan area is migratory range and the species is not known to breed there.[3]
Common Poorwill (*Phalaenoptilus nuttallii*)	G4 MT S4B SD S3B, SZN	Common and reproducing in Ashland and Sioux Districts of plan area, including South Dakota portion of plan area (Montana Natural Heritage Program, South Dakota Natural Heritage Program). Entire plan area is summer/ breeding range for the species.	Evaluated due to recommendation from South Dakota Game, Fish and Parks. Not identified as potential species of conservation concern. Apparently secure globally and in Montana. Common and well-distributed in the Pine Savanna Ecosystem of the plan area, including South Dakota portion. South Dakota portion of plan area is primary summer range, and Harding County is core to the distribution. Lack of info on potential threats due to nocturnal, secretive nature of the species.[3]
Cooper's Hawk (*Accipiter cooperii*)	G5 MT S4B SD S3B	Common and well distributed (i.e., found on all landscapes) across the plan area, including South Dakota portion of Sioux District. Entire plan area is year-round or summer range.	Evaluated due to recommendation from South Dakota Game, Fish and Parks. Not identified as potential species of conservation concern. Globally secure, apparently secure in Montana. Common and well distributed across the plan area. South Dakota is year-round habitat, and the population appears to be increasing. Threats include conversion or loss of mature, deciduous forest.[3]
Ferruginous Hawk (*Buteo regalis*)	G4 MT S3B SD S4B	Few observations in plan area; most involve transient (migrating) individuals; one record with indirect evidence of breeding on Sioux District (Montana). Entire plan area is within	Evaluated due to Sensitive designation on Shoshone National Forest. Not identified as potential species of conservation concern. Limited habitat in Montane Ecosystem of plan area. Insufficient evidence species is established or becoming established in plan area. Population trend data from breeding bird surveys and Christmas Bird Count significant increases

Species Name	Conservation Ranking	Distribution in Plan Area[1]	Rationale for Evaluating and Identifying or Not as Potential Species of Conservation of Concern
		summer/breeding range for the species; however, grassland habitat used by this species for breeding is more abundant outside the plan area.	in Montana, South Dakota and nationally; but reliability is low due to low densities. Primary threat is disturbance at nest site.[2,3] No known active nest sites within the plan area.
Flammulated Owl (*Psiloscops flammeolus*)	G4 MT S3 SD S1	Two records (1993, 1994) indirect evidence of breeding in Montane portion of plan area; subsequent surveys failed to detect species in plan area. The 1993 report is undocumented and needs verification.[2] Only a few, accidental sightings of this species reported for South Dakota.[3]	Evaluated due to state rank in South Dakota; potential species of conservation concern on Helena-Lewis and Clark National Forest, and sensitive on Beaverhead-Deerlodge National Forest and Caribou-Targhee National Forest. This species is on the Region 1 Sensitive Species list as suspected to occur on the Gallatin. Not identified as potential species of conservation concern. Insufficient evidence the species is established or becoming established in plan area; not detected with species-specific surveys. Montane Ecosystem at eastern edge of species range; Pine Savanna Ecosystem (including South Dakota) well outside species range per NatureServe range map.
Grasshopper Sparrow (*Ammodramus savannarum*)	G4 MT S4B SD S4	Entire plan area within summer range, but species occurrence limited to pine savanna ecosystem of plan area. Common and documented breeding in Ashland and Sioux Districts.	Evaluated due to sensitive species designation on Shoshone National Forest. Not identified as potential species of conservation concern. Apparently secure globally and in plan area states. Species common and reproducing in Pine Savanna Ecosystem of plan area. Suitable habitats (grasslands) typically located at lower elevations outside plan area in Montane Ecosystem.
Gray-crowned Rosy Finch (*Leucosticte tephrocotis*)	G5 MT S2B, S5N SD No Record	Plan area is mainly winter range for this species; occurrence as migrant or overwintering is infrequent, but widespread across Montane Ecosystem.	Evaluated due to state ranking in Montana. Not identified as potential species of conservation concern State rank of S2B refers to breeding range. Plan area is winter range; state rank for winter range is secure. Threat: alpine species vulnerable to climate change.[2]
Great Gray Owl (*Strix nebulosa*)	G5 MT S3 SD No Record	Known to occur across most of the Montane Ecosystem of the plan area, including confirmed breeding. Pryor Mountains, Ashland and Sioux Districts outside the range of this species.	Evaluated due to sensitive designation on Caribou-Targhee National Forest. Not identified as potential species of conservation concern due to wide distribution across suitable habitat (i.e., Montane Ecosystem). Lack of information indicating declining populations/habitat, and/or substantial threats in plan area. North American population relatively stable. Little known about Montana population status and habitat needs. Threat: snag reduction.[2]
Greater Sage-grouse (*Centrocercus urophasianus*)	G3 MT S2 SD S2	Species occurs in sagebrush rangelands primarily outside of plan area. Small numbers currently known to occur in the Pryor Mountains within the plan area. Historically present on the Ashland and	Evaluated due to global and state rankings. This species is on the Region 1 Sensitive Species list as suspected to occur on the Custer. Identified as potential species of conservation concern because of limited numbers of sage-grouse, and presence of core habitat in the plan area. Sage-grouse populations have been declining nationally and in the plan

Species Name	Conservation Ranking	Distribution in Plan Area[1]	Rationale for Evaluating and Identifying or Not as Potential Species of Conservation of Concern
		Sioux Districts and occasionally sighted there.	area, and the species was recently considered for Federal listing under the Endangered Species Act. Historic leks within the plan area have not been verified as occupied for over a decade. Primary threat is sagebrush removal for agriculture and/or to improve grazing for livestock.[2]
Harlequin Duck (*Histrionicus histrionicus*)	G4 MT S2B SD Not Ranked	Transient (migrating) individuals have been observed across the Montane Ecosystem, except for the Pryor Mountains. Breeding has been confirmed along swift moving streams within, or surrounded by, the Absaroka Beartooth Wilderness Area. The Pryor Mountains, Ashland and Sioux landscapes are outside the species' range.	Evaluated due to state ranking in Montana, potential species of conservation concern on Helena-Lewis and Clark National Forest, and sensitive on Beaverhead-Deerlodge National Forest, Caribou-Targhee National Forest and Shoshone National Forest. This species is on the Region 1 Sensitive Species list as known to occur on the Custer and Gallatin. Not identified as potential species of conservation concern due to continued presence of the species in known occupied breeding habitat within the plan area. Occupied habitat is located within or near designated Wilderness. Additional suitable habitat is available, but surveys are lacking for species presence during the breeding season in many parts of the plan area, limiting knowledge of distribution and abundance. Breeding population in Rocky Mountains relatively stable; habitat degradation from logging and mining important factors in past population declines. Adult fidelity to nest streams, low likelihood of re-nesting after incubation, and irregular levels of reproductive success make this species vulnerable to local extinctions and low likelihood of recolonization.[2]
Hooded Merganser (*Lophodytes cucullatus*)	G5 MT S4 SD S2B	Generalist species associated with forested lotic systems but will also use marshes and small ponds. Primarily migratory observations recorded; however, known to use suitable habitat throughout the plan area. Montane ecosystem is year-round range; pine savanna is migratory range.	Evaluated due to state ranking in South Dakota. Not identified as potential species of conservation concern. Widely distributed across the Montane landscapes of the plan area and apparently secure across Montana. South Dakota portion of plan area is migratory range and the species is not known to breed there.[3]
Horned Grebe (*Podiceps auritus*)	G5 MT S3B SD S2B	Entire plan area is outside the breeding range for this species (Montana Natural Heritage Program). Some migratory individuals documented in the plan area, primarily in the Montane Ecosystem.	Evaluated due to state ranking in South Dakota Not identified as potential species of conservation concern. South Dakota ranking of S2B refers to breeding range; South Dakota portion of plan area is migratory range and the species is not known to breed there.[3]
Lewis's Woodpecker (*Melanerpes lewis*)	G4 MT S2B SD S3B, S3N	Observations of transient individuals have occurred at low frequency across the plan area. Breeding has been confirmed on the Ashland and Sioux Districts. The entire plan area is within summer range for the species. However, preferred	Evaluated due to state ranking in Montana; potential species of conservation concern on Helena-Lewis and Clark National Forest and sensitive on Shoshone National Forest. Not identified as potential species of conservation concern. In Montane Ecosystem, habitat is typically found at lower elevations, outside plan area. In pine savanna ecosystem, open ponderosa pine and woody draws

Species Name	Conservation Ranking	Distribution in Plan Area[1]	Rationale for Evaluating and Identifying or Not as Potential Species of Conservation of Concern
		habitat; e.g., riparian cottonwood open ponderosa pine and burned pine, are more common in the pine savanna landscapes.[2]	provide habitat. Burned ponderosa pine forest is readily available on Ashland District. Population declines noted in breeding bird surveys, but low sample size reduces reliability. Threats: loss of older cottonwood and/or mature ponderosa pine; increased density in ponderosa pine (fire suppression); and loss of snags (fire salvage and firewood collection).[2]
Loggerhead Shrike (*Lanius ludovicianus*)	G4 MT S3B SD S3	Entire plan area is within summer/ breeding range. Sporadic observations of mainly migratory individuals occur in the Montane Ecosystem. Indirect evidence of breeding recorded on both Ashland and Sioux Districts of the pine savanna ecosystem.	Evaluated due to sensitive species designation on Shoshone National Forest. This species is on the Region 1 Sensitive Species list as known to occur on the Custer. Not identified as potential species of conservation concern. Breeding habitat (open woodlands, fields) typically found at lower elevations, outside plan area in Montane Ecosystem. Habitat is present and indirect evidence of breeding is documented in pine savanna ecosystem. Populations relatively stable in Montana, but lack info on habitat/breeding requirements. Vulnerable to pesticides.[2]
Long-billed Curlew (*Numenius americanus*)	G5 MT S3B SD S3B	Entire plan area is within summer/breeding range, but there are few observations of this species within the plan area. The species has been detected near Hebgen Lake, as well as on the Ashland and Sioux Districts during breeding season, but breeding has not been confirmed in the plan area.	Evaluated due to listing as sensitive on Shoshone National Forest. This species is on the Region 1 Sensitive Species list as known to occur on the Custer. Not identified as potential species of conservation concern suitable habitat is short grasslands devoid of trees, and moist meadows, which are limited within the plan area and often found in greater abundance at lower elevations outside of plan area. Threats are permanent conversion of native habitat for agriculture or human development, which typically does not occur on National Forest System lands in the plan area. Population trends lacking for Montana[2], but show significant decline in South Dakota from 1966–2003 (breeding bird survey). Threats include nest disturbance, agricultural practices, predation, and pesticides/herbicides.[3]
Long-eared owl (*Asio otus*)	G5 MT S5 SD S3B, S3N	Entire plan area is within year-round range of the species. Observations occur across much of plan area, although breeding has been confirmed only on the Ashland and Sioux Districts, including South Dakota portion. Breeding habitat (hedgerows, woody draws, and juniper thickets) are most common on Ashland and Sioux Districts of the plan area.	Evaluated due to recommendation by South Dakota Game, Fish and Parks. Not identified as potential species of conservation concern. Secure globally and in Montana. Common throughout Montana; uncommon, but widespread and reproducing in plan area. Determining population trends can be difficult due to nomadic lifestyle; i.e., follow food source; prey may be cyclic.[2] South Dakota, including plan area, considered year-round range for this species, but they are erratic, and occur locally. Despite wide distribution, it is relatively uncommon for reasons unknown.[3]
Merlin (*Falco columbarius*)	G5 MT S4 SD S3B, SZN	Entire plan area is within year-round ranger for the species. Known to occur across entire plan area. Mainly transient (migratory) individuals observed in Montane Ecosystem, but common in Pine	Evaluated due to recommendation by South Dakota Game, Fish and Parks. Not identified as potential species of conservation concern.

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		Savanna Ecosystem. Most evidence of breeding documented on Sioux District, including South Dakota portion.	Globally secure and apparently secure in Montana; present across most of plan area, more common in eastern landscapes, including South Dakota portion of Sioux Ranger District. Dramatic population increases have been noted for this species in the 1980s and 1990s, after earlier declines associated with pesticide use (NatureServe). South Dakota portion of plan area is year-round range for this species. Numbers have declined in Harding County, for unknown reasons. Threats include loss of habitat and pesticide use.[3]
Mountain Plover (*Charadrius montanus*)	G3 MT S2B SD SX	Only one documented occurrence (in 2010) of a transient (migrating) individual within the plan area. This observation was at the edge of the plan area, with an estimated accuracy of 1,000 meters.	Evaluated due to global and state ranking in Montana; sensitive designation on Shoshone National Forest. Not identified as potential species of conservation concern. Insufficient evidence the species established or becoming established in plan area. Suitable habitat is short-grass prairies and prairie dog towns, which are generally small, and of limited numbers in the plan area. The Montana Natural Heritage Program field guide shows much of the plan area as summer range for this species, except for the Madison/Gallatin/ Absaroka and Beartooth landscape, which shows as migratory range. However, the NatureServe range map for the Western Hemisphere shows most of the plan area to be outside the species range.
Northern Goshawk (*Accipiter gentilis*)	G5 MT S3 SD S3B, S2N	Plan area is mostly within year-round range for the species, which is known to occur across the plan area. Breeding has been confirmed in all forested landscapes of the plan area; but no recent confirmed breeding for the South Dakota portion. Forest-wide monitoring shows consistent use of smaller diameter nest trees in the plan area than reported elsewhere within the species' range.	Evaluated due to state ranking in South Dakota; sensitive on Shoshone National Forest and Caribou-Targhee National Forest. Not identified as potential species of conservation concern. Globally secure. U.S. Fish and Wildlife Service status review (1998) found no evidence of declining population trend. Goshawk was removed from Region 1 Sensitive Species list in 2007 due to inventories demonstrating sufficient habitat and distribution of this species, including the plan area. Breeding bird survey and migration counts are inadequate for assessing population trends[2]; South Dakota portion of plan area is primary winter range for the species. Although rare, year-round occurrence has been recorded there.[3] Threats: processes that remove large trees (timber harvest, fire, insects); but effects of these processes at the population level are unknown.[2] Sensitive to disturbance around nest sites.[3]
Northern Harrier (*Circus cyaneus*)	G5 MT S4B SD S5	Entire plan area is within year-round range for the species. Known to occur with indirect evidence of breeding across the plan area.	Evaluated due to sensitive on Shoshone National Forest. Not identified as potential species of conservation concern. Widespread distribution across plan area and secure ranking at global and state levels. This is a grassland-associated species that will avoid nesting in areas overgrazed by livestock (i.e., prefers taller, dense vegetation in nesting areas).[2]

Species Name	Conservation Ranking	Distribution in Plan Area[1]	Rationale for Evaluating and Identifying or Not as Potential Species of Conservation of Concern
Northern Saw-whet Owl (*Aegolius acadicus*)	G5 MT S4 SD S3B, S3N	Known to occur with evidence of reproduction in all landscapes of the plan area, including the South Dakota portion of the Sioux District. The Montane Ecosystem is year-round range, while the Pine Savanna landscapes are mainly considered winter range for this species in Montana.	Evaluated due to recommendation by South Dakota Game, Fish and Parks. Not identified as potential species of conservation concern. Globally secure, apparently secure in Montana; well distributed and reproducing across the plan area in Montana and South Dakota. There are multiple records of successful nests in the South Dakota portion of the Sioux District (South Dakota Natural Heritage Program, Rocky Mountain Bird Observatory 2012). Most abundant small owl in Canada and the United States[2], including western South Dakota.[3] Threats include snag removal. South Dakota portion of plan area is primary summer (e.g., breeding) range for this species. Threats include loss/fragmentation of mature pine habitats; nocturnal nature and cryptic coloring make it difficult to study; hence, there is a lack of info for this species.[3]
Olive-sided Flycatcher (*Contopus cooperi*)	G4 MT S4B SD SU, SZ	Known to occur and reproduce throughout Montane Ecosystem of plan area, where breeding habitat is present. The Pine Savanna Ecosystem is outside the breeding range for this species, and there are no observations of this species from the Ashland or Sioux Districts.	Evaluated due to sensitive species on Shoshone National Forest. Not identified as potential species of conservation concern. The species is apparently secure in Montana and widely distributed across the Montane Ecosystem of the plan area where suitable habitat occurs. Habitat for the olive-sided flycatcher is maintained by natural disturbance. Breeding bird survey data show significant population declines rangewide. Data from Montana had inadequate sample size for reliable trend but showed insignificant increase. Vulnerable to habitat destruction on winter range (tropics). Threats in breeding range include removal of large/tall snags.[2]
Osprey (*Pandion haliaetus*)	G5 MT S5 SD S1B (T)	Known to occur across the plan area in Montana. Breeding has been confirmed within the plan area, but nesting habitat is associated with large lakes and rivers, many of which are near, but outside plan area. Not currently known to occur in the plan area within South Dakota. Most of the plan area is within summer/breeding range; however, the Sioux District is migratory range.	Evaluated due to state ranking and "threatened" status in South Dakota. Not identified as potential species of conservation concern. Secure globally and in Montana. Wide distribution across majority of plan area. S1B ranking in South Dakota is for breeding habitat; however, South Dakota portion of plan area is migratory range (not breeding habitat) for the species.[3] Numbers plummeted mid-20th century due to DDT, but have since rebounded. Uncommon to rare breeder in eastern Montana (muddy waters not suitable). Breeding bird survey data show significant population increase in western Montana (6.1 percent/year; 1966–2010). Threats mainly associated with issues on neotropical wintering grounds, but chicks can get tangled in fishing line and bailing twine brought to nests by adults.[2] Chronic disturbance by people and/or pets, and contamination of food supply (fish) can impact this species.[3]
Peregrine Falcon (*Falco peregrinus*)	G4 MT S3 SD SXB	The entire plan area is within the species' range. Species occurrence and reproduction are known across the Montane Ecosystem of the plan area.	Evaluated due to sensitive on Beaverhead-Deerlodge National Forest, Caribou-Targhee National Forest and Shoshone National Forest. This species is on the Region 1 Sensitive Species list as known to occur on the Custer and Gallatin. Delisted in 1999, still monitored by agencies.

Species Name	Conservation Ranking	Distribution in Plan Area[1]	Rationale for Evaluating and Identifying or Not as Potential Species of Conservation of Concern
		Currently, only transient observations (migrating individuals) recorded in the Ashland and Sioux Districts.	Not identified as potential species of conservation concern. Severe population declines nation-wide in mid-late 20th century due to use of DDT. No nesting pairs in Montana in the 1970s. Reintroduction efforts in 1980s–1990s resulted in a six-fold increase in the number of breeding pairs in Montana from 1994–2009.[2] The number of observations and nest sites has increased in the plan area since the early 1990s, resulting in widespread distribution and increased occupation of breeding habitat within much of the plan area.
Prairie Falcon (*Falco mexicanus*)	G5 MT S4 SD S3S4B, S4N	Common, reproducing and well-distributed across the plan area, including South Dakota. Entire plan area is within year-round range for this species.	Evaluated due to recommendation by South Dakota Game, Fish and Parks. Not identified as potential species of conservation concern. Globally secure, apparently secure in Montana, apparently secure in South Dakota, but some uncertainty. Common and well-distributed in plan area. South Dakota portion of plan area is year-round range for the species; nest sites declined from 1970s to 2011, but still present.[3] Generally a non-forest habitat species, the plan area has limited suitable habitat, yet the species is present and well-distributed. Potential threats include grass fires, overgrazing of livestock, energy development and pesticide use. Species appears to tolerate disturbance from human activity (e.g., recreation, construction).[2,3]
Pygmy Nuthatch (*Sitta pygmaea*)	G5 MT S4, SD S2S3	Montana portion of plan area is within year-round range of this species. There is only one observation of a transient individual in the Montane Ecosystem landscapes. However, the species is common, with known breeding in the Ashland District, and at least one record of possible breeding on the Montana portion of the Sioux District. Ponderosa pine is preferred breeding habitat, and is most abundant on Ashland and Sioux Districts.	Evaluated due to uncertainty in South Dakota ranking. This species is on the Region 1 Sensitive Species list as not known or suspected to occur on the Custer or Gallatin. Not identified as potential species of conservation concern. Globally secure, apparently secure in Montana, present and reproducing in suitable habitat in the plan area. Species is known from the Black Hills of South Dakota, and is not known to occur in South Dakota portion of plan area.[3] Absent from areas with no long-needled pines. Populations appear stable with possible slight decline. Timber harvest and/or fires that remove mature ponderosa pine are potential threats, but also can be used as tools to maintain the mature, open structure preferred by this species.[2]
Sage Thrasher (*Oreoscoptes montanus*)	G4 MT S3B SD S2B	Much of the plan area is within summer range for the species. Only transient (migratory) observations recorded for the Madison/ Gallatin/ Absaroka and Beartooth and Bridger/Bangtail/ Crazy landscapes. Transient use and indirect evidence of breeding recorded in the Pryors. Species is common and reproducing on Ashland District, and also	Evaluated due to state ranking in South Dakota. Not identified as potential species of conservation concern. Species is present in suitable habitat in plan area. No adequate population trend data for plan area. Threats include permanent conversion of sage habitat for human use, effects of non-native plants and climate change (NatureServe). However, literature indicates sage thrashers less impacted by disturbance factors than other sage obligate species (Reynolds, et al. BNA Online 2016; Gilbert and Chalfoun 2011). Breeding bird survey data suggest non-

Species Name	Conservation Ranking	Distribution in Plan Area[1]	Rationale for Evaluating and Identifying or Not as Potential Species of Conservation of Concern
		recorded on Montana portion of Sioux District. In South Dakota, species was present in low numbers in 1980s–1990s, but not found 2009–2012 in the plan area.	significant population declines in Montana. Species considered a rare breeder in Harding County, South Dakota; Species favors sagebrush, but not obligate (also uses other brush species; e.g., greasewood, bitterbrush). Threats include any actions or natural processes that remove or reduce sagebrush habitat; e.g., prescribed burning for "rangeland improvement". Sage thrashers detected on both active and inactive sage-grouse leks.[2]
Sharp-tailed Grouse (*Tympanuchus phasianellus*)	G5 MT S1S4 SD S4	This species is known to occur in suitable grasslands throughout the plan area, but with only transient observations in the Montane Ecosystem. The species is common and confirmed breeding on Ashland and Sioux Districts. While the entire plan area is considered year-round range for this species, the grass, shrub, and brush-filled coulees used as breeding habitat are less abundant in the Montane Ecosystem.	Evaluated due to state ranking in Montana and sensitive designation on the Caribou-Targhee National Forest. Not identified as potential species of conservation concern. State rank of S1 only applies to populations west of the continental divide. The plan area is fully east of the continental divide, where populations have a state ranking of S4 (Montana Natural Heritage Program).
Short-eared Owl (*Asio flammeus*)	G5 MT S4 SD S3	Entire plan area within species range. Transient observations recorded for the Madison/ Gallatin/ Absaroka and Beartooth landscape, the Bridger/Bangtail/ Crazy Mountain landscape and the Ashland District. There is indirect evidence of breeding on the Sioux District. The species appears to be more common outside the plan area, in lower elevation habitats, often on private lands.	Evaluated due to sensitive designation on Shoshone National Forest Not identified as potential species of conservation concern. Secure globally; apparently secure in Montana, and recorded to be using suitable habitat where available within the plan area. Lack of information for population status and trend info in Montana.[2] In South Dakota, breeding bird survey data show non-significant population increases from 1966–2003, but the more recent data (1980–2003) show significant declines.[3] Populations may cycle with prey species (e.g., voles). Breeding bird survey and CBS not good indicators for population trends due to low sample sizes, but both show declines in North America. Threats include permanent conversion of native grasslands and overgrazing by livestock.[2]
Sprague's Pipit (*Anthus spragueii*)	G4 MT S3B SD S2	There have been only two, transient observations of this species on the Ashland District. No records of the species occurrence in the South Dakota portion of the plan area. Montane ecosystem is within migratory range; pine savanna ecosystem is within summer range for the species.	Evaluated due to State ranking for South Dakota. This species is on the Region 1 Sensitive Species list, but not known or suspected to occur on the Custer or Gallatin. This species had been listed as a candidate species for the Custer National Forest until recently, when the U.S. Fish and Wildlife Service issued a finding of "not warranted" for Federal listing (*FR* 81(65) April 2016) Not identified as potential species of conservation concern. Insufficient evidence the species is established or becoming established in the plan area. Breeding bird survey data indicate significant population increases in Montana and South Dakota, whereas pops were declining elsewhere. Threats include permanent loss of native grasslands, overgrazing by livestock, cowbird parasitism and invasion of non-native

Species Name	Conservation Ranking	Distribution in Plan Area[1]	Rationale for Evaluating and Identifying or Not as Potential Species of Conservation of Concern
			plant species (especially grasses). Light grazing and periodic light fires can be beneficial.[2,3]
Three-toed Woodpecker (*Picoides dorsalis*)	G5 MT S4 SD S2	Observations have been recorded in all landscapes of the plan area, except the South Dakota portion of Sioux District. Breeding has been confirmed in the Madison/Gallatin/ Absaroka and Beartooth landscape of the Montane Ecosystem. The Ashland and Sioux Districts are outside the range for this species.	Evaluated due to state ranking in South Dakota. Not identified as potential species of conservation concern. The species is present and reproducing in suitable habitats of the Montane Ecosystem. Breeding habitat in the plan area has increased in recent years due to large wild fires and broad-scale insect infestations. In South Dakota, the species is known to occur only in the Black Hills[3], which is outside of the plan area. Lack of information on population trends and factors that influence numbers. Most common in post-fire habitats, but also in mixed conifer. Primary threat is post-fire logging.[2]
Trumpeter Swan (*Cygnus buccinator*)	G4 MT S3 SD S3	The plan area is primarily migratory range for this species, except for a relatively small area of year-round habitat in the Madison/Gallatin landscape. Accordingly, observations in the plan area are of migrating and or wintering individuals. Breeding habitat for this species is located southwest of the plan area in the Red Rock Lakes Refuge area. The species is known to winter along the Madison River and near Hebgen Lake in the plan area.	Evaluated due to sensitive designation on Beaverhead-Deerlodge National Forest, Caribou-Targhee National Forest, and Shoshone National Forest. This species is on the Region 1 Sensitive Species list as known to occur on the Gallatin. Not identified as potential species of conservation concern. The plan area provides migratory and wintering range for the species and is being used as such. The wintering population of trumpeter swans in the western United States increased dramatically from 1973–2002 and has remained relatively stable in Montana (Montana Natural Heritage Program 2016). Human disturbance at wintering areas can cause energetic stress. Bison hazing with helicopters near Hebgen Lake was reported to disturb hundreds of wintering trumpeter swans. They may also be vulnerable to lead poisoning from ingesting lead shot and lead fishing sinkers.[2]
Veery (*Catharus fuscescens*)	G5 MT S3B SD S2B	The species is known to occur across the plan area, with direct evidence of breeding recorded for all but the Sioux District. Breeding habitat is dense, riparian shrub, often found at lower elevations within and outside the plan area. The entire plan area in Montana is within summer range for the species.	Evaluated due to state ranking in South Dakota. Not identified as potential species of conservation concern. Globally secure. Common and reproducing in suitable habitat, which is generally distributed near plan area boundaries. In South Dakota, the species is known from the Black Hills and the extreme northeast portion of the state, but it is not known to breed in the South Dakota portion of the plan area.[3] Breeding bird survey data indicate significant population decline in Montana; steeper decline than elsewhere in species' range.[2] Data for South Dakota are insufficient to determine population trends.[3] Threats include cowbird parasitism where livestock influence riparian habitat; e.g., reduction of understory vegetation density.[2]
Yellow-billed Cuckoo (*Coccyzus americanus*)	G5 MT S3B SD not ranked	The entire plan area is within summer range for the species. However, preferred habitats (e.g., riparian shrub, cottonwood, willow thickets, open woodlands and abandoned farmlands) are typically found	Evaluated due to sensitive designation on Caribou-Targhee National Forest. Not identified as potential species of conservation concern. Insufficient evidence species is established or becoming established in plan area. This

Species Name	Conservation Ranking	Distribution in Plan Area[1]	Rationale for Evaluating and Identifying or Not as Potential Species of Conservation of Concern
		at lower elevations outside the plan area. There is only one (provisional) observation on the Ashland District.	species has experienced serious population declines in the west due to loss/conversion of riparian habitat. Suspected to be an occasional breeder in Montana, although no nests have been found.[2]
Mammals			
American marten (*Martes americana*)	G5 MT S4 SD No Record	Known to occur in Montane Ecosystem of plan area, not in pine savanna ecosystem. The pine savanna ecosystem is outside the range for this species (Montana Natural Heritage Program). Common; classified as a furbearer with a trapping season in Montana.[4]	Evaluated because sensitive on Shoshone National Forest. Not identified as potential species of conservation concern. Globally secure, apparently secure in Montana, with wide distribution in Montane Ecosystem of plan area; suitable habitat lacking in pine savanna ecosystem. Populations reduced by habitat loss due to timber harvest and fire, as well as heavy trapping harvest, but still common in western Montana.[4]
Bighorn Sheep (*Ovis canadensis*)	G4 MT S4 SD S4	Sixteen separate herds occur within the Montane Ecosystem of the plan area; most tend to be small and isolated. Upper Yellowstone herd is well-connected and robust. Common; classified as a big game species.[4]	Evaluated due to sensitive status on Beaverhead-Deerlodge National Forest and Caribou-Targhee National Forest. This species is on the Region 1 Sensitive Species list as known to occur on the Custer and Gallatin. Not identified as potential species of conservation concern. Numerous small populations persist in suitable habitat. Threats are primarily due to contact with domestic sheep and/or goats. No active sheep allotments on Custer Gallatin National Forest. All bighorn sheep populations on Custer Gallatin National Forest are currently hunted. Populations declined precipitously over past century due to competition with, and disease transmission from, domestic livestock.[4]
Bison (*Bison bison*)	G4 MT S2 SD S3	Bison occur seasonally in the Madison/ Gallatin/ Absaroka and Beartooth landscape. Nearly exterminated at turn of century due to overharvest.[4]	Evaluated due to state ranking in Montana. Not identified as potential species of conservation concern. State ranking is due to low and/or declining population numbers. Bison in plan area are managed under the Interagency Bison Management Plan that dictates population levels. Primary threat is human tolerance.
Black Bear (*Ursus americana*)	G5 MT S5 SD S1	Common and well-distributed throughout the Montane Ecosystem of the plan area. Increasing occurrences in pine savanna ecosystem in recent years.	Evaluated due to state ranking in South Dakota. Not identified as potential species of conservation concern. Secure globally and in Montana; wide distribution across majority of plan area. South Dakota Game, Fish and Parks (2016) indicates the species is not known to occur in South Dakota.
Black-tailed Prairie Dogs (*Cynomys ludovicianus*)	G4 MT S3 SD S4	This species is known to occur in small colonies on the Ashland District. The Madison/Gallatin/ Absaroka and Beartooth landscape is outside the range for the species. Most habitat in the Bridger/ Bangtail/Crazy Mountain landscape of the plan area is unsuitable due to elevation	Evaluated because this species is on the Region 1 Sensitive Species list as known to occur on the Custer. Not identified as potential species of conservation concern. The species is present in suitable habitat within the plan area, but populations are suppressed by recreational shooting (i.e., colonies are typically small). The U.S. Fish and Wildlife Service determined that black-tailed prairie dogs were not warranted for protection under the Endangered Species Act in

Species Name	Conservation Ranking	Distribution in Plan Area[1]	Rationale for Evaluating and Identifying or Not as Potential Species of Conservation of Concern
		and/or topography, but habitat occurs outside the plan area in lowland areas. Habitat is most abundant in the Pryors, Ashland and Sioux Districts.	2009. Threats include impacts from recreational shooting. Prairie dogs are dual-designated in Montana as non-game (Montana Fish, Wildlife & Parks) as well as vertebrate pest (Montana Department of Agriculture). There are currently no regulations restricting the shooting of non-game species. The species is also vulnerable to plague, which is transmitted through social activities such as grooming (Nistler 2009).
Fringe-tailed Myotis (*Myotis thysanodes*)	G4 MT S4 SD S2	Fringed myotis have been detected in the Pryors, and are common on the Ashland District and Montana portion of the Sioux District, but have also been detected on the South Dakota portion of Sioux District (Montana Natural Heritage Program).	Evaluated due to state ranking in South Dakota. This species is on the Region 1 Sensitive Species list as known to occur on the Custer. Not identified as potential species of conservation concern. NatureServe distribution map shows entire plan area outside the species' range. However, species is present and well-distributed in suitable habitat within the plan area. Information is lacking for distribution and relative abundance, and unavailable for population trends. Threats are disturbance at hibernacula (caves, mines) and possibly disease, such as white-nose syndrome; closely related to *M. lucifugus*, which is highly susceptible.[5]
Gray Wolf (*Canis lupus*)	G4 MT S4 SD SA	Known to occur across the majority of the plan area with known breeding territories in the Montane Ecosystem landscapes, and transitory or incidental occurrences moving eastward.	Evaluated because recently removed from Endangered Species Act list of threatened and endangered species. It is on the Region 1 Sensitive Species list as known to occur on the Custer and Gallatin, as well as sensitive on Beaverhead-Deerlodge National Forest and Caribou-Targhee National Forest. Not identified as potential species of conservation concern. Species apparently secure globally and in Montana. Demonstrated consistent increases in number and distribution in western Montana, including Montane Ecosystem of plan area in recent years.[4] The species is managed by the state with hunting and trapping seasons, as well as management removals. Primary threat is human tolerance; e.g., livestock depredations.
Hoary Bat (*Lasiurus cinereus*)	G5 MT S3 SD S5	Observations have been made throughout the plan area in all districts (Montana and South Dakota).	Evaluated due to sensitive designation on Shoshone National Forest Not identified as potential species of conservation concern. Secure globally and in South Dakota. Population trend info lacking, but species present and well-distributed across plan area. Potential threats include collisions with wind turbines. No connection with white-nose syndrome as of 2015.[5]
Little Brown Myotis (*Myotis lucifugus*)	G3 MT S3 SD S5	This species is found throughout the planning area.	Evaluated due to global ranking as rare or locally abundant, but vulnerable. Not identified as potential species of conservation concern. The species is relatively abundant and widely distributed across the plan area. White-nose syndrome is considered a threat to the global population.[5] This serious pathogen has not yet been documented within the plan area, but

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			has recently been verified in other states to the east and west of the plan area. Also vulnerable to collision with wind turbines,[5] although currently no wind energy developments within plan area.
Long-eared Myotis (*Myotis evotis*)	G5 MT S4 SD S1	The species is found throughout every landscape in the plan area. In South Dakota, long-eared myotis are found on the Sioux Ranger District (as cited by Jones and Genoways 1967; Jones et al. 1985; Higgens et al. 2000; Montana Natural Heritage Program 2016).	Evaluated due to state ranking in South Dakota. This species is on the Region 1 Sensitive Species list as known to occur on the Custer and Gallatin. Not identified as potential species of conservation concern. The species is present and well-distributed across the plan area, including multiple detections in the South Dakota portion of the Sioux District (Montana Natural Heritage Program mapviewer). Threats include possible susceptibility to white-nose syndrome, and collisions with wind turbines.[5]
Mountain Lion (*Puma concolor*)	G5 MT S4 SD S2	Generalist species, common throughout the plan area, except for the Sioux District, with only one known occurrence in the Montana portion.	Evaluated due to state ranking in South Dakota. Not identified as potential species of conservation concern secure globally and apparently secure in Montana. Widely distributed across majority of plan area (Montana Natural Heritage Program). In South Dakota, the species is mainly found in Black Hills, where it is managed as big game (i.e., hunted). Known to disperse through prairie ecosystem (i.e., near or through Sioux District, South Dakota units) but no documentation of lions establishing home ranges in prairie habitats (South Dakota Game, Fish and Parks 2010, 2016).
Pallid Bat (*Antrozous pallidus*)	G4 MT S3 SD not ranked	Pallid bat has been observed in the Pryors and Ashland District. The plan area west of the Pryor Mountains is outside the range for this species (Montana Natural Heritage Program).	Evaluated because the species is on the Region 1 Sensitive Species list as known to occur on the Custer. Not identified as potential species of conservation concern. Species apparently secure globally, and is present and reproducing within the range of the species for the plan area. Information is lacking on abundance, distribution and population trend. Potential management issues include threats to water supply (e.g., contamination from oil/gas development). No known mortalities at wind turbines or connection with white-nose syndrome as of 2015.[5]
Pika (*Ochotona princeps*)	G5 MT S4 SD Not Ranked	Pika are present at high elevations in the Montane Ecosystem west of the Pryor Mountains.	Evaluated due to potential threats from climate change. Pikas show intolerance for high ambient temperatures. Not identified as potential species of conservation concern. No evidence of population declines in plan area. The highest elevation habitat in Montana is within the plan area (Beartooth Mountains). Climate impacts are uncertain, but thought to be potentially less than other areas due to elevation.
River otter (*Lontra canadensis*)	G5 MT S4 SD S2 (T)	Known to occur in riverine habitats of Montane portion of plan area. Does not	Evaluated due to S2 ranking and state “threatened” status in South Dakota; sensitive on Shoshone National Forest.

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		occur in pine savanna portion of plan area (including South Dakota)	Not identified as potential species of conservation concern due to apparently secure rank and wide distribution across majority of plan area. Classified as a furbearer in Montana, with regulated trapping season[4]. Southeast Montana outside the range for this species (Montana Natural Heritage Program; Montana Fish, Wildlife & Parks). No suitable habitat in Harding County (i.e., plan area), South Dakota (South Dakota Game, Fish and Parks 2012). Threats: can be inadvertently caught in traps set for beaver.
Sagebrush Vole (*Lemmiscus curtatus*)	G5 MT S4 SD S1	The entire plan area is within the range for this species, but observations are limited to two undated observations (recorded between 1937 and 1969); most likely due to lack of surveys.	Evaluated due to state ranking in South Dakota. Not identified as potential species of conservation concern. Secure globally and apparently secure in Montana. While there is information regarding a general decline in sagebrush habitat, there is a lack of information regarding population trends, and/or identifying potential threats, for the sagebrush vole.
Spotted Bat (*Euderma maculatum*)	G4 MT S3 SD Not Ranked	Spotted bats have been observed in the Pryors and on Ashland District within the plan area.	Evaluated due to sensitive designation on Beaverhead-Deerlodge National Forest, Caribou-Targhee National Forest, and Shoshone National Forest. This species is on the Region 1 Sensitive Species list as known to occur on the Custer. Not identified as potential species of conservation concern. Species apparently secure globally. Present at very low densities within plan area. Insufficient information to determine population trends at state or plan area scale. No connection with white-nose syndrome or wind turbine mortalities as of 2015.[5]
Townsend's Big-eared Bat (*Corynorhinus townsendii*)	G3, G4 MT S3 SD S2	Species has been detected primarily in the Pryors, Ashland and Sioux landscapes, but with a few records in the Madison/ Gallatin/ Absaroka and Beartooth landscape as well. No known maternal roosts, but the species has been found at winter hibernacula in the plan area. Only two observations in South Dakota dating back to 1961 (South Dakota Game, Fish and Parks).	Evaluated due to global and state ranking; potential species of conservation concern on Helena-Lewis and Clark National Forest ; sensitive species on Beaverhead-Deerlodge National Forest, Caribou-Targhee National Forest, and Shoshone National Forest. This species is on the Region 1 Sensitive Species list as known to occur on the Custer and Gallatin. Not identified as potential species of conservation concern. Species is present and well-distributed; with multiple observations in the central and eastern portions of the plan area. White-nose pathogen detected in the species (not in the plan area), but no diagnostic sign of white-nose syndrome suggesting the bat may be a potential winter roost vector. No wind turbine mortalities reported as of 2015.[5]
Water vole (*Microtus richardsoni*)	G5 MT S4 SD No Record	Known to occur in Montane Ecosystem of plan area, but records are few and dated (most prior to 1984) due to limited survey efforts. Pine Savanna Ecosystem outside the species range.	Evaluated because sensitive on Shoshone National Forest. Not identified as potential species of conservation concern. Secure globally and apparently secure in Montana. Observations are few, but well-

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			distributed within species range for plan area. Lack of information on population trends or threats identified for this species.
White-tailed Prairie Dog (*Cynomys leucurus*)	G4 MT S1 SD Not Ranked	Within the plan area, this species is only known to occur in the southwest corner of the Pryor Mountain landscape. Southern Carbon County (where the species occurs) is the extent of the species range in Montana, which is at the northern tip of the species range in the Western Hemisphere (NatureServe).	Evaluated due to state ranking in Montana, and sensitive on Shoshone National Forest. This species is on the Region 1 Sensitive Species list as known to occur on the Custer. Identified as potential species of conservation concern. Known to occur in only a small portion of the plan area. Montana State Wildlife Action Plan (2015) lists the species as highest priority for conservation need, indicating a "high risk of extirpation".
Reptiles			
Hog-nosed Snake (Plains/Western) (*Heterodon nasicus*)	G5 MT S2 SD S5	Range of this species only includes the Pryor Mountains, Ashland, and Sioux Districts in the plan area. Observations are limited to the Ashland District, where the species is common.	Evaluated due to state ranking in Montana. This species is on the Region 1 Sensitive Species list as known to occur on the Custer. Not identified as potential species of conservation concern. Secure globally and in South Dakota. Common where present in plan area (Ashland District). There is a lack of information regarding population numbers and trends for the plan area.
Sage Brush Lizard (*Sceloporus graciosus*)	G5 MT S4 SD S2	The species has been observed in all but the Bridger/Bangtail/ Crazy Mountain landscape of the plan area, with the bulk of the observations concentrated in the Ashland District. The species is also common outside the plan area in lower, warm, dry habitats; mainly near the Pryors and Ashland District.	Evaluated due to state ranking in South Dakota. Not identified as potential species of conservation concern due to secure global ranking and wide distribution across majority of plan area.
Short-horned Lizard (*Phrynosoma hernandesi*)	G5 MT S3 SD S2	Range of this species includes the Bridger, Bangtail, and Crazy Mountains, Pryor Mountains, Ashland and Sioux Districts, and the northern periphery of the Madison, Henrys, Gallatin and Absaroka and Beartooth Mountains. Observations have occurred in all but the Bridger/Bangtail/Crazy Mountain landscape.	Evaluated due to state ranking in South Dakota. This species is on the Region 1 Sensitive Species list as known to occur on the Custer. Not identified as potential species of conservation concern. Species secure globally. Few observations in plan area due to limited survey efforts; yet wide distribution across majority of plan area.
Western Milksnake (*Lampropeltis gentilis*)	G4G5 MT S2 SD Not Ranked	Range of this species includes all but the southwest portion of the plan area, but observations are limited to the Ashland District, where the species is relatively common.	Evaluated due to state ranking in Montana. This species is on the Region 1 Sensitive Species list as known to occur on the Custer. Not identified as potential species of conservation concern. Species is thought to be secure globally. State ranking of S2 is largely due to lack of

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			information about the species in Montana (Montana Natural Heritage Program).
Invertebrates			
Frigga Fritillary (*Boloria frigga*)	G5 MT S1S2 SD Not Ranked	Only one observation of this species in the plan area (Madison Range 2006).	Evaluated due to state ranking in Montana. Not identified as potential species of conservation concern. Species secure globally. Montana ranking of S1S2 due to lack of surveys and information for this species (Montana Natural Heritage Program). Threats to bog or subalpine habitat unlikely with forest management activities.
Gray Comma (*Polygonia progne*)	G5 MT S2 SD Not Ranked	Only one observation within the plan area, in the Montana portion of the Sioux District.	Evaluated due to state ranking in Montana. Not identified as potential species of conservation concern. Species secure globally. Lack of information on threats and population levels/trends in the state.
Monarch (*Danaus plexippus*)	G4 MT S4B SD Not ranked	Known to occur in plan area. Milkweed patches (breeding habitat) present in pine savanna ecosystem of plan area.	Evaluated due to recommendation by South Dakota Game, Fish and Parks. Not identified as potential species of conservation concern. Apparently secure globally and in Montana but information on abundance and distribution lacking. Threats to populations are mainly associated with wintering habitat (outside United States).

[1] Unless otherwise indicated, observation data and range maps are from the Montana Natural Heritage program database and field guide: http://fieldguide.mt.gov.

[2] Marks, J.S., P. Hendricks and D. Casey. 2016. Birds of Montana. Buteo Books, Arrington, VA.

[3] South Dakota Game Fish and Parks website: http://arcgis.sd.gov/server/gfp/wap/species.

[4] Foresman, K. 2012. Mammals of Montana, Second Edition. Mountain Press Publishing Company. Missoula, Montana.

[5] Maxell, B. 2015. Montana Bat and White-Nose Syndrome Surveillance Plan and Protocols 2012–2016; Updated 30 October 2015. Montana Natural Heritage Program. Helena, Montana.